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American Machinist

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Volume 70 | New York, June 27, 1929 | Number 26

Forging the Chevrolet Crankshaft

By George E. Hagemann
Associate Editor, American Machinist

FORGE shops have rarely been considered seriously as the place where mechanical methods of production and handling could be applied successfully to any great extent. Even though engaged in the manufacture of interchangeable products with a high volume of output, most forge shops have been laid out according to class of work rather than sequence of operations. Once in production, they could not conveniently be rearranged because equipment was heavy, foundations were too massive to change, and steam lines furnishing the power were not easily relocated. It was only when a new forge shop was erected that modern methods became readily applicable.

This crankshaft forging shop uses straight-line production and mechanical handling to obtain a daily output of 7,500 pieces with a 4½-hour cycle

A little over a year ago the production of crankshafts at the forge division of the Chevrolet Motor Company presented problems which opened the way to a restudy of manufacturing methods. The new six-cylinder car was under design, considerable new equipment was required, and more than 200 men were needed for the production to be turned out. The full capacity of the existing forge shop was demanded for the making of other parts for the new model. It was possible, therefore, to develop a plan that had been under consideration for some time, whereby the forging of crankshafts would be segregated from other forging work and arranged as a continuous manufacturing process, with equipment laid out for straight-line production, and mechanical handling replacing manual labor wherever possible.

A new shop 440 by 85 ft. in size, and of single-story construction, was designed and erected around the layout of the manufacturing and handling procedure. Since the production cycle was entirely independent of other forging operations, it was not necessary to connect the new plant with the old. This shop was provided with new furnaces, hammers, presses, conveyors and heat-treating equipment of the latest design.

Steel for this forge plant is received in open cars and is unloaded by magnet crane and stored in bins adjacent to the forge shop, as shown in Fig. 1. On the ends of each bar a standard color is painted by the supplier to indicate the nature of the steel, and only one heat is sent in each car. As the steel is unloaded, the bins are labeled and samples of the steel are cut and sent to the laboratory for analysis. Upon receipt of a

Fig. 1—From storage the crane delivers the bars to the shear sheds, at the right, where they are then cut to proper length for the crankshafts

Fig. 2—The sheared bars are fed into the forging furnace, which is oil-fired and automatically controlled, and are heated to 2,280 deg. Fahrenheit

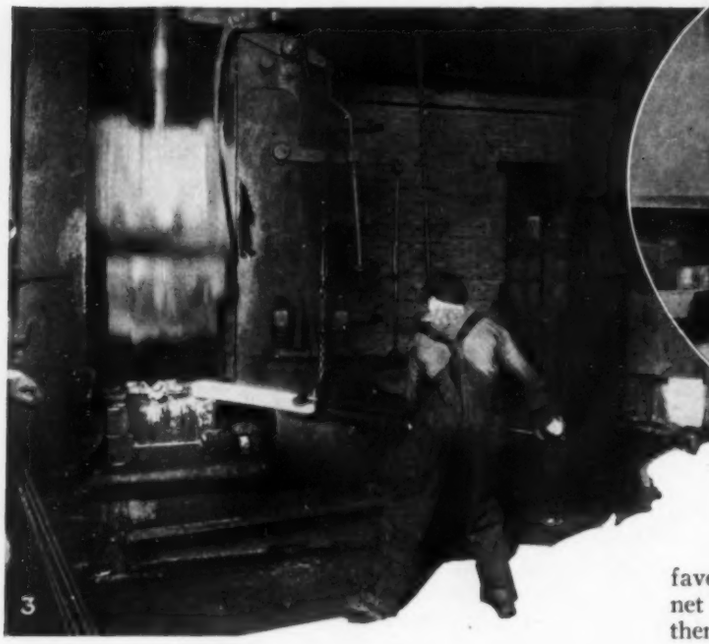


Fig. 3—The heated bars are handled by tongs supported on a monorail track, and are rolled, broken down, and forged to final shape, in a 12,000-lb. hammer

favorable report the steel is released for production. Magnet cranes carry the bars to the shear sheds and unload them on rollers carrying them to the shears. The bars are cut to length for the crankshafts and are stacked in racks which are carried to the forging furnaces by electric lift trucks.

The furnaces, illustrated in Fig. 2, are of the automatic pusher type and are oil-burning. Bars are fed through automatically, one going in as another one is removed at the outlet end, and are heated to a temperature of 2,280 deg. F. The temperature is controlled automatically by pyrometers. The bars are then withdrawn by tongs supported from a chain carried on an overhead monorail conveyor, and are fed into a 12,000-lb. hammer, Fig. 3, where in three operations in successive cavities of the die they are rolled while being forged,

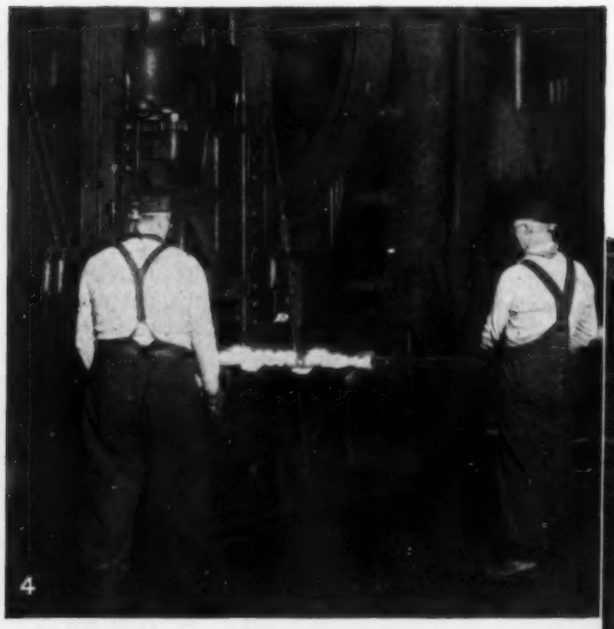


Fig. 4—The flash and the tong hold are cut from the forging in a trimming press, the tongs for handling the crankshaft being supported from an overhead monorail

Fig. 5—An overhead chain conveyor carries away the scrap, the operator hanging the flashes on hooks and placing the tong-holds on pans suspended from this conveyor

Fig. 6—The conveyor carries the scrap into the yard and over a railroad car, or a storage bin, where a tripper tilts the hooks and drops the flashes. The tong holds are carried to other storage bins where a second tripper tilts the pans and discharges them

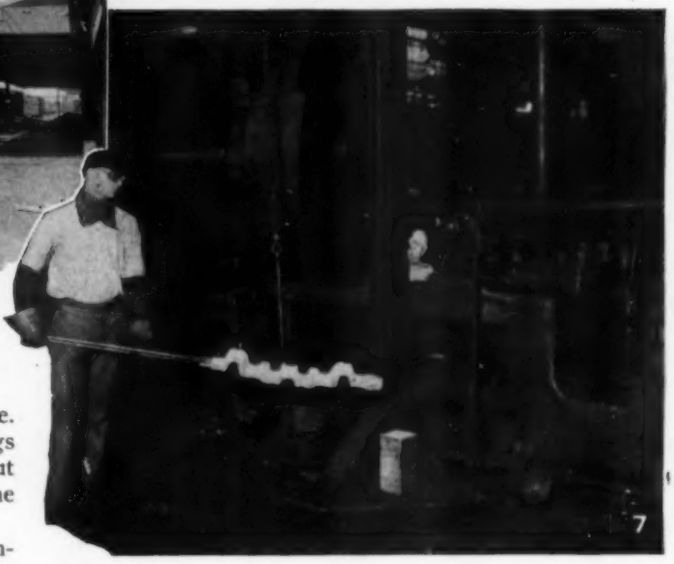


Fig. 7—The crankshaft is removed from the back of the trimming press by tongs supported from a monorail, and placed in an upsetter which forms the flange on one end

broken down to rough shape, and forged to final shape. They are then fed to a trimming press, Fig. 4, by tongs carried on the monorail conveyor, where the flash is cut off, and the tong end is separated from it, in one operation.

An overhead chain conveyor traverses the line of hammers and is equipped with two types of carriers. One type is a hook, and on these hooks the flashings are hung, as in Fig. 5. Alternating with the hooks are small pans, and into these the cut-off tong ends of the forgings are placed. These ends are used as stock blanks for hubs.

The conveyor carries the flashing and tong ends through the forge shop and into the yard. Here there are located a railroad spur track and storage bins, Fig. 6. First, as the conveyor passes over a steel gondola car located on the spur track, a tripper set at any desired point tilts the

Fig. 8—The crankshafts are placed in a 5,000-lb. hammer and restruck in two positions 90 deg. apart. They are then stamped and hung on a monorail conveyor

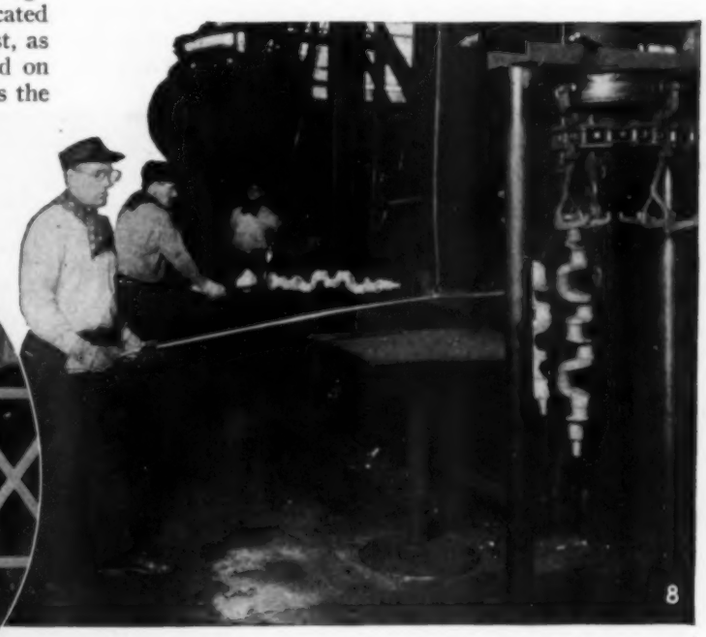


Fig. 9—The crankshafts are carried to the heat treating furnaces on the monorail conveyor, which dips down at loading stations at each of the five forging units

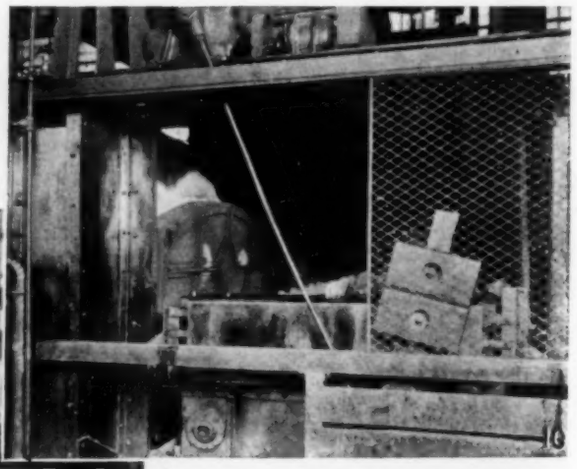


Fig. 11—At the discharge end of the drawing furnaces gravity slides receive the crankshafts and deliver them to hydraulic straightening presses for removal of distortions. Cradles fall into boxes and are sent back to the loading station on a chain conveyor

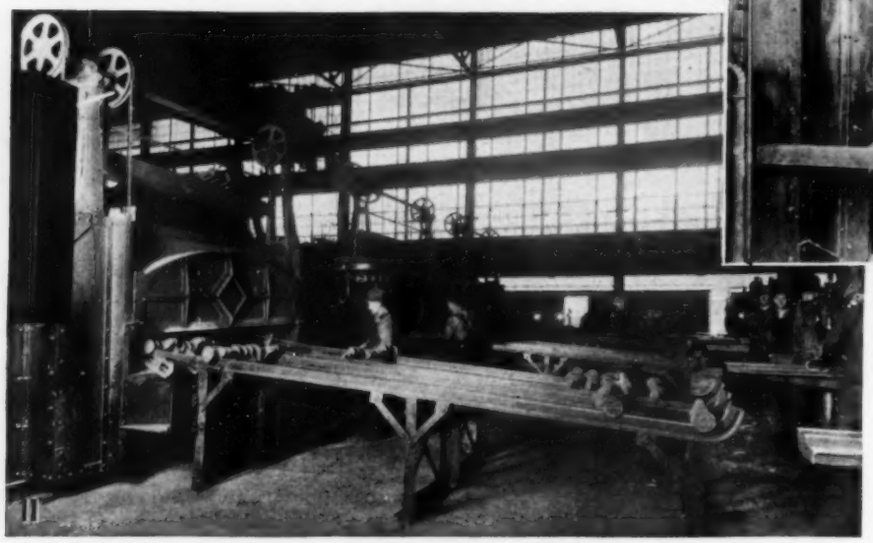


Fig. 10—After heat-treating, the crankshafts are picked up from the carrying cradles and dipped into quench tanks by arms which then return them to the cradles for delivery to the drawing furnaces. The heat treating cycle is 2 min. and 20 seconds

hooks and the flashings fall into the car. If there is no car on the spur, the flashings pass beyond this point to the storage bins, where they are tripped off into the bins. They are later loaded by a magnet crane into open cars and sold as scrap. The pans carrying the tong ends are not affected by this tripper, and the conveyor carries them along until they are over another set of storage bins. Here a second tripper, installed to empty the pans, tilts them until the tong ends fall out. These tong ends are loaded into lift-truck boxes by the magnet crane and are delivered to the other forge shop for forging into hubs.

From the trimming press the crankshaft forging is carried to an upsetter by tongs on an overhead monorail conveyor, as in Fig. 7. On this machine the flange is upset on one end. From here it goes to a 5,000-lb. steam hammer, Fig. 8, where it is restruck in two positions in two successive cavities in the dies. First it is restruck 90 deg. from the plane in which it was forged. This operation rounds up all the bearings and rectifies any distortion set up in the trimming and upsetting operations. It is then hand-stamped with two different symbols, one representing the company which supplied the steel and the other the crew which made the forging. Any defects in material or workmanship can be traced to original sources by these symbols. It is then placed on an overhead monorail conveyor. The total time elapsed from the time the heated steel leaves the forging furnace until it is placed on the conveyor is about 90 sec. The production per unit averages about 100 per hour.

There are five units or sets of forging furnaces and hammers in operation for the production of crankshafts. On the conveyor the crankshaft is hot-inspected and is then carried down the shop, as shown in Fig. 9, to the heat-treating furnace. The forgings are unloaded from this conveyor and placed on the charging end of the heat treat furnaces by an operator who operates two unloading

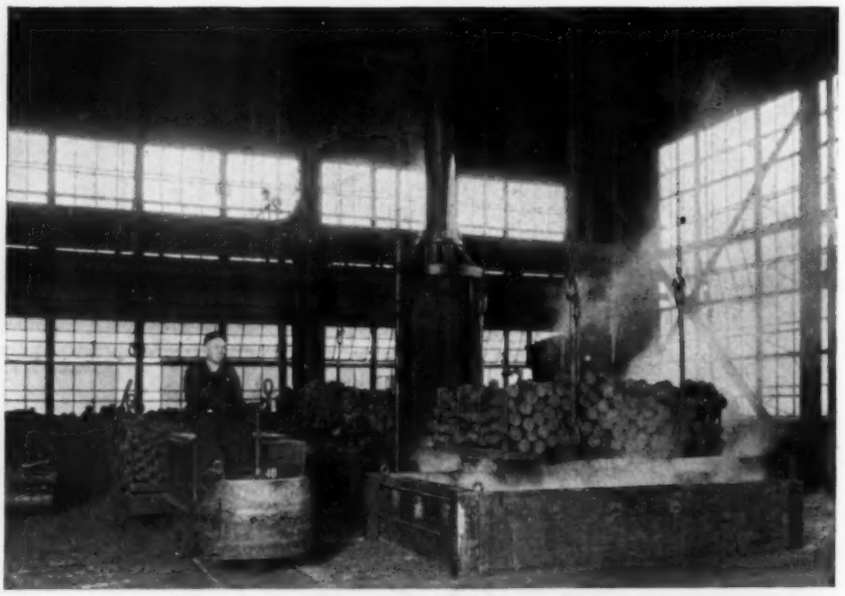


Fig. 12—The forgings are loaded on acid-resisting bronze containers at the straightening presses and delivered to the pickling room. Two four-station machines are used for pickling and one hour is required

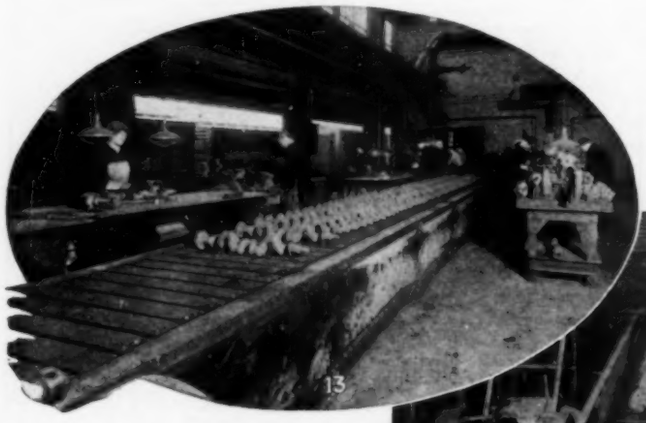


Fig. 13—After going through the pickling operation the crankshafts are spot-ground, tested for hardness by the Brinell method, inspected for defects in metal or finish, and gaged, or indexed, for correct throw, spacing of cheeks, and other important dimensions. They are then ready for shipping. Only 0.3 per cent, or one in 333, fails to pass the rigid examination. A slat conveyor carries the crankshafts between these final operations

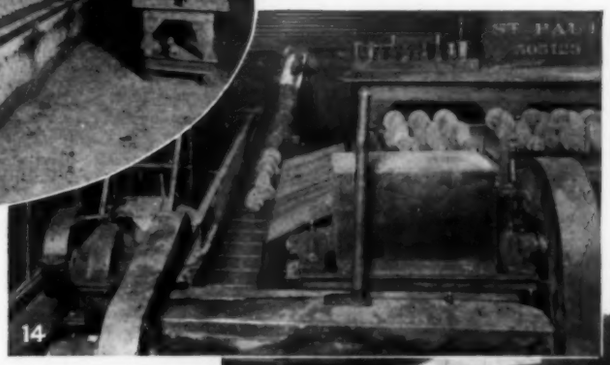


Fig. 14—The inspection-line conveyor discharges the crankshafts to a short section of slat conveyor running out to the shipping platform, which is alongside of the building. The forgings are fed to this conveyor by gravity, and travel lengthwise. Fig. 15—The cross-conveyor feeds a portable slat conveyor on the shipping platform. This conveyor can be located to reach the door of any car spotted on the track. The crankshafts are removed by hand from the conveyor and are stacked in box cars for delivery to the company's machine shops

devices. By this time the temperature in the crankshaft has dropped to between 700 and 1,000 deg. F. This initial heat in the forging saves considerable fuel in heat-treating furnaces.

The heat-treating furnaces, of which there are three sets, are oil-burners. The hardening furnaces are held at an average temperature of 1,500 deg. F., within 10 deg. plus or minus. Leeds and Northrup temperature regulators and recorders control furnace temperatures and enter the readings on continuous charts. They are similar to the instruments which control temperatures in the forging furnaces. The furnaces are fully automatic. On the inlet end the operator places alloy steel cradles on which the crankshafts are placed, as they are removed from the overhead conveyor. The heat treating cycle is 2 min. and 20 sec. At the expiration of this period the doors open at each end. At the inlet end a pusher feeds four crankshafts into the furnace, and they are moved forward one space (four crankshafts) every 2 min. and 20 sec., until they reach the opposite end. Here, as they are forced out by the action of the pusher on the new charge at the inlet end, they are picked up on arms which lower them into a water quench, Fig. 10, until they are cool, the cradles remaining on the feed plate. Just previous to the beginning of the next cycle in the heat-treating furnace, the arms bring up the cooled forgings and deliver them to the same cradles which carried them through the hardening furnace, ready to go into the drawing furnace. Then the arms return to position to receive the next charge of forgings for quenching.

The forgings are automatically fed into and through the drawing furnace by means of a pusher mechanism operating like the one on the hardening furnace. The drawing furnace also burns oil and is maintained at an average temperature of 1,100 deg. F., by pyrometer control, the same as the other furnaces. The cycle is likewise 2 min. and 20 sec., between feeds, and synchronizes with the cycle of the hardening furnace. From the discharge end of the furnaces, gravity slides, Fig. 11, carry the forgings to a row of straightening presses where they are tested for alignment and distortions are removed, while still hot. They are then loaded on trays, or containers, of acid-resisting bronze, carried by trucks, and are delivered to the adjacent pickling department.

A four-station pickling machine, Fig. 12, of the Mesta type is used to clean the forgings. At the first station the containers are loaded and unloaded from the overhead carrying-arm of the machine. At the second station the containers of crankshafts are dipped in the sulphuric acid bath, maintained at a strength of 2.2 per cent and a temperature of 180 deg. F. The acid is purchased as 66 deg. Baumé and contains about 93.2 per cent of pure acid as bought. At the third station they are immersed in another sulphuric acid bath of a strength of 2.2 per cent and a temperature of 180 deg. F. At the fourth station they are rinsed in clear water heated to 170 deg. F. The immersion period in each tank is 20 min.

The crankshafts are then spot-ground for Brinell testing and placed on a slat conveyor. This conveyor, Fig. 13, carries them between two Brinell hardness-testing machines, where they are tested and must come within the limits of 3.6 mm. and 4.0 mm. at a 3,000 kg. load with a 10 mm. ball, Brinell hardness number 286 to 228. The conveyor then carries them between two inspection

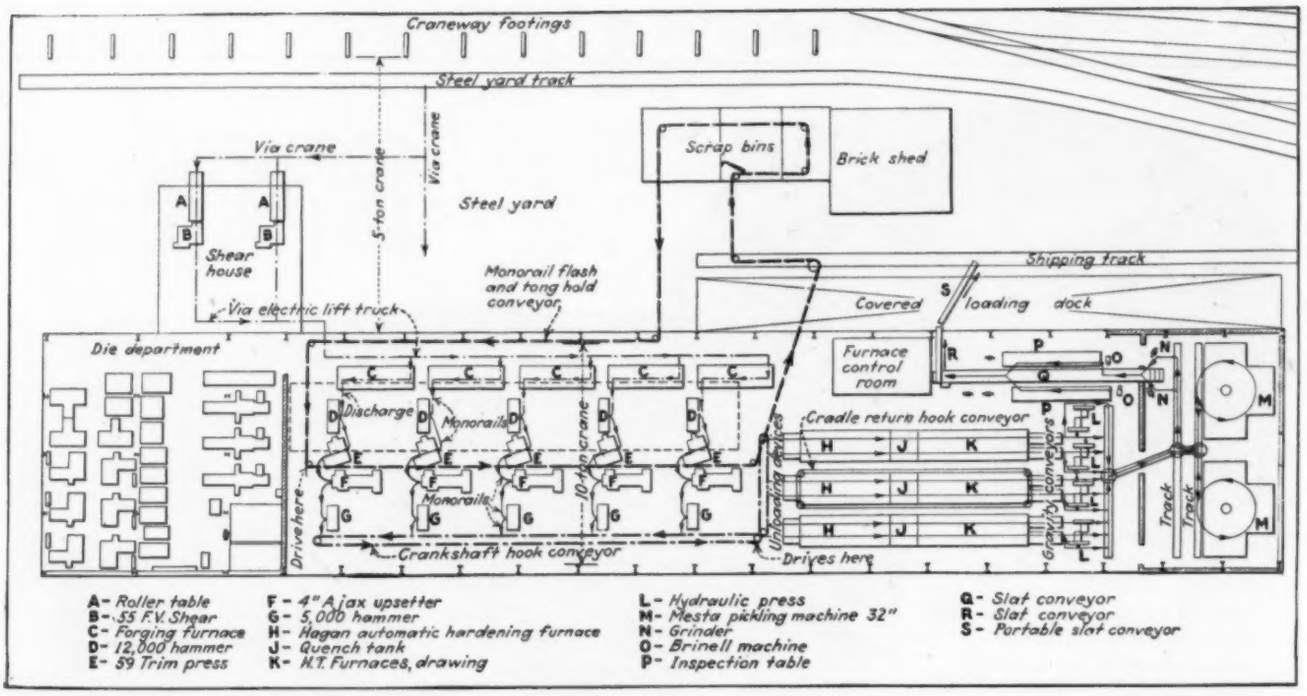


Fig. 16—The crankshaft forge shop is laid out for straight-line continuous production, with no stock of parts at any operation. Travel of the metal from the original bar stock, through all processes, and finally into the railroad car for shipment is indicated by arrowed lines on the drawing. The various conveyor systems are also indicated. There are five forging units, three heat-treating furnaces, and two pickling machines. This equipment handles 7,500 crankshafts per day. The time required to convert bar stock into crankshafts, delivered at the shipping platform, is only 4½ hours. A total of 225 men is employed in this new forge shop

stations where they are removed and inspected for forging defects, such as cold shuts. The next operation is indexing, or a careful gaging for correctness of throw, spacing of cheeks, etc. Any crankshaft which may need adjustment is removed. Only 0.3 per cent, or one in 333, fail to pass the final inspection and are rejected.

From the final inspection the crankshafts again go on the conveyor line, are discharged to a slat cross-conveyor, Fig. 14, and from this onto a portable conveyor, Fig. 15, feeding them into railroad cars for delivery to the machine shop.

The layout of the new forge shop for crankshafts is shown in Fig. 16. A fully equipped die-shop, where dies for the forging of the crankshaft are made, is located at one end of the shop. All of the die-sinking is done on Keller engraving machines.

The course of the steel throughout successive operations is indicated by the arrowed lines. These start from the steel-yard track, where bar stock is unloaded, follow through to the shear shed, thence to forging furnaces, hammers, presses and upsetters, of which there are five complete units, then to the crankshaft hook-conveyor delivering the forgings to three series of heat-treating and drawing furnaces, and finally through straightening, pickling, Brinell testing and inspection operations, to shipping. The flash and tong-end conveyor, leading out to cars and storage bins in the yard, is shown by heavy dash lines in the drawing.

The new forge shop employs a total of 225 men for the manufacture of over 7,500 crankshaft forgings per 24-hr. day of three shifts. The time elapsing between the placing of a bar in the forging furnace until it is loaded into the box car as a crankshaft is less than 4½ hours.

The success of this development, and the reduction in total costs of forging it has brought about open the way for the extension of the idea to other parts produced in quantity. It is probable that similar methods will gradually become common in most forge shops operating under mass production, because they have an economically sound precedent in machine shops, sheet metal shops, body building, assembly operations, and other manufacturing divisions of the automobile industry.

A Peep into Volume 71

Facts and figures on real production jobs will be given in articles on "What Obsolete Equipment Costs" in the 71st volume of the *American Machinist* beginning July 4. Some unusual material for the designer will also be given in coming articles, including some new approaches to gear mathematics by Professor Buckingham, a full authoritative description of the Zeiss planetarium, and several articles concerning practical oil filtration and pressure lubrication. Some new slants on production from the manager's standpoint are also promised, with one on "Precision in a Low-Priced Product" in the July 4th number. "Production in a Job Shop," in the July 11th number, continues the series on the work of the small shop.

Heat-Treating Parts for Textile Machinery

By Chester B. Lord
Associate Editor, American Machinist

The life of a circular knitting machine depends upon the wearing qualities of a multitude of small heat-treated parts, some of which are quite intricate

ACCURACY of machining and proper heat-treatment are outstanding factors in the successful manufacture of circular knitting machines. It is for this reason that H. Brinton & Company placed its heat-treating department in a building separate and distinct from its factory. This company believes that light and ventilation are just as essential to good work in this important branch of its manufacture as in any other, and that by keeping the department separate it would not be considered an adjunct of the mechanical departments, but co-equal and just as important as any other department. This arrangement is in contrast to the usual practice in which the heat-treating department is placed in some location that cannot be used for other manufacturing purposes.

At the Brinton plant the heat-treating department has an abundance of light from three sides, and is ventilated by both natural and induced methods. A general view of the department is shown at Fig. 1. From this and the other illustrations it will be seen that it is equipped throughout with the latest methods of heating, tempering, testing and recording, and that the equipment it contains is suited to the requirements of the different parts that are treated. No attempt is made to have a furnace or bath serve for more than one class of work, unless there is an outstanding advantage in doing so.

There are open, muffle, and revolving furnaces, both large and small. Each has a bath of oil, water or both that corresponds to the size and needs of the furnace it serves.

The testing equipment is varied and suited to the variety of material to be tested. Some of the parts present a problem by their lack of thickness, others by their lack of width. The peculiarities of each part has been given consideration, and it is assigned to a Brinell, Rockwell, or scleroscope testing apparatus as its shape or size requires.

Small parts that will stand tumbling are carburized in the rotary carburizing machine and furnace shown in Fig. 2. The parts to be carburized are placed in a small cylinder which protrudes from the front end, and which revolves on the wheels shown at the front and rear. The furnace as a whole swings on trunnions for charging and discharging the small cylinder.

The carburizing agent usually employed with this furnace is illuminating gas, but if the gas available is not sufficiently rich in carbon, a carburizing compound is placed loosely in the cylinder with the parts to be treated. Using the granular compound is considered

Fig. 1 — This heat-treating department is located in a separate building and is provided with an abundance of light and ventilation on three sides. All hardening and tempering operations are checked by hardness tests

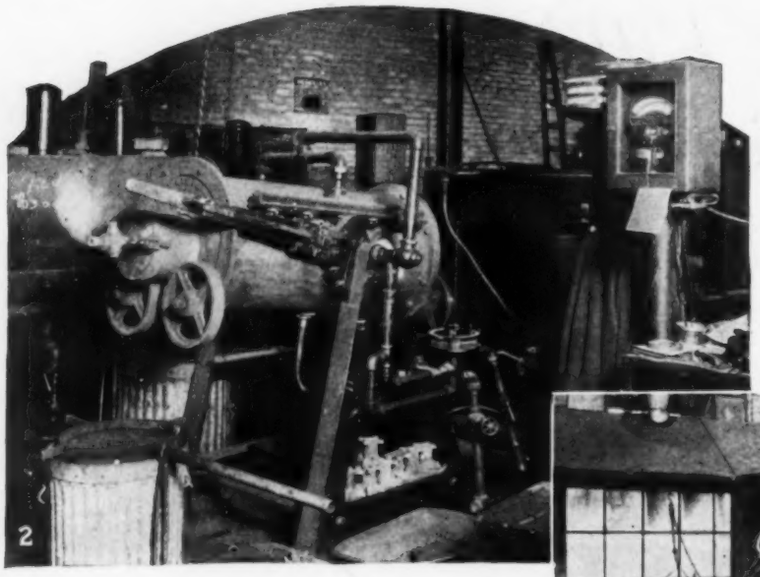


Fig. 2—The work to be hardened is placed in the small cylinder, together with the carburizing material. Heating the outside of the cylinder gasifies this material. The spent gas is ignited as it passes into the air, and thus prevents the entrance of oxygen

Fig. 3 — This casehardening furnace and its oil tempering bath are placed in closed booths with means for induced ventilation. This arrangement allows unrestricted access to them, but prevents gas from entering the main room when they are in use

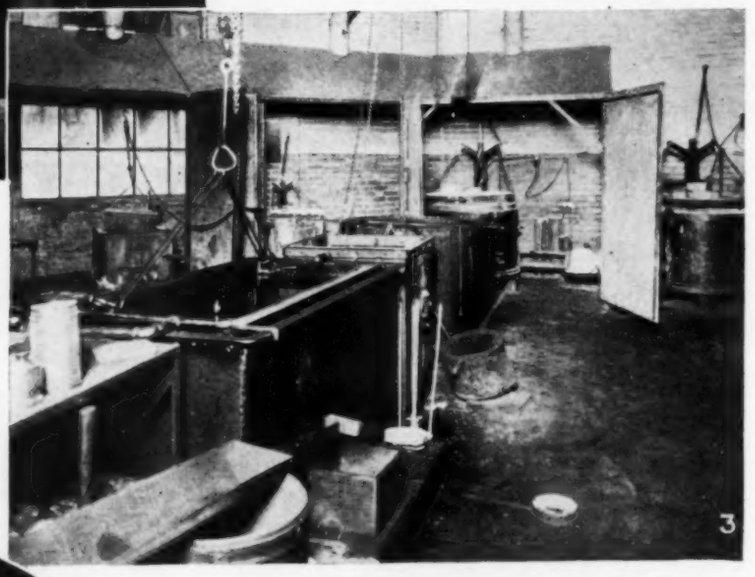


Fig. 4—Some of the cylinders made by this company require a 48-in. furnace. A cylinder for a circular knitting machine has from 16 to 24 vertical slots per inch of circumference. To heat-treat these slots without injury requires extreme care

Fig. 5—Battery of furnaces for small and individual parts. Each one has its pyrometer and no attempt is made to use judgment in hardening or tempering. A bath is placed near each furnace, so that no time is lost in quenching

good practice in any case where the parts are so delicate that they will not stand tumbling without a cushion of some sort.

Gas may or may not be used in combination with the compound. When employed, it enters the small cylinder at the center of the rear end through a universal joint, which permits the cylinder to turn and tip. After the small cylinder is packed, the gas in the chamber surrounding it is lighted, and when the temperature in the small cylinder reaches the point at which carburization begins, the gas is turned into it. The cock in front is opened just enough to emit the spent gas, which is ignited to keep it from escaping into the room. The escaping gas prevents the entrance of oxygen, and also acts as a telltale.

It requires from six to eight hours for a charge, depending upon the thickness of the case. When the time is up and the sheet from the recording pyrometer has been examined and checked, the gas is shut off, the front of the small cylinder is opened, and the contents is dumped into the sieve shown under it. A few shakes separates the compound, and the parts are dumped into the bath. In some cases they are normalized afterward, in others not.

Cyanide, lead, and oil are also used as mediums for hardening, heating and drawing. The cyanide and oil heating furnaces shown in Fig. 3 are placed in separate sheet-metal booths having swinging doors and equipped for induced draft. When the doors are closed neither the heat nor the fumes are noticeable outside. The baths are placed outside the booth, but are convenient, and the doors are so large that there is no interference with rapid handling of material from furnace to bath.

Unequal Sections Are Carburized

The result desired in all carburizing operations is to secure a good depth of case without any blistering or change of shape. In this case the accomplishment of this result is made somewhat difficult by the delicacy of some of the parts, and the small sections that stand out prominently from large bodies. Needle cylinders, for instance, vary in size from 4 to 48 in. and in height from 4 to 10 in. Some cylinders may have as many as 24 slots to each inch of their outer circumference. The slots are about 0.02 in. wide, by $\frac{1}{4}$ in. or more deep, the full height of the cylinder, and form a guide for the oscillations of the needles. They must be straight and to gage; smoothness of surface is also an essential, as a rough surface under the circumstances, is the equivalent of a fine file. As the wall between the slots is also about 0.02 in. the task of handling these cylinders even when cold is a delicate one.

The large circular furnace shown in Fig. 4 was installed to heat the larger sizes of cylinders, the intention being to use a swirling flame. While this method has been quite successful in small furnaces, it has been found that the size of the furnace in which the flame can be made to follow a spiral path is limited, probably because the velocity of the air blast is not sufficient to keep the flame in a horizontal plane and against the side of the furnace. In such cases deflectors assist in heating the work uniformly.

The furnaces shown in Fig. 5 are used for hardening small miscellaneous lots and individual parts, such as gears, ratchets and similar parts. It will be noted that they all have pyrometers, and are situated immediately under large windows, so as to discourage the use of judgment by color values in hardening and tempering.

SEEN · AND · HEARD

By John R. Godfrey

Grinding Tungsten-Carbide Tools —Naming the New Cutting Tools

IN THE old carbon-tool days a small oil stone was part of every lathe man's kit, to use in stoning the finishing tools to a smooth cutting edge. As with almost everything else, some men overdid it, and "stoned the tools to death," that is they not only smoothed the edges but dulled them. With the advent of high-speed steel tools and the grinding machine as a finishing operation, the oil stone disappeared except in the toolroom or for stoning reamers.

The new tungsten-carbide tools seem likely to bring back the oil stone or its equivalent—a lap charged with fine abrasives that is hard enough to cut the new alloys. And not so much for the purpose of securing a smooth surface on the material as to save the tool itself.

Under a microscope the edge left by the usual grinding wheel is a series of serrations, the size of the teeth depending on the grain of wheel used. These teeth, or minute projections, seem to give way under heavy cuts, or vibrations. By smoothing the edge and removing these "points," the tools stand better and may give better results in finishing. For those who have begun to use these new tools it is suggested that they be ground first with a 60 wheel, then with a 120 and finally with a lap or disk charged with 220 abrasive. Experiments indicate that these give very satisfactory results. It is felt that the fact that these alloy tools can be ground in the average shop with a little care as to equipment and methods give them a great advantage over the diamond for many kinds of work, as in most cases the diamond must be sent away for grinding or dressing.

The grinding of tungsten-carbide tools, however, is too costly to be left to the tender mercies of the average machine operator, and this fact should tend to make the central, or toolroom grinding system universal. With proper equipment that includes wheels with as many sizes of abrasives as may be necessary, the grinding of new tools need not be difficult, and standardization of tool shapes should be made easier.

With increased production at lower costs as the main object, we shall work out methods that may eventually simplify our tool grinding.

* * *

NOW that the use of tungsten-carbide tools is being extended we are confronted with the disadvantage of designating them by a compound word of four syllables. Trade names cannot be used as a class designation, and the full classification as "tungsten-carbide" is somewhat clumsy.

Why not coin a word that is easy to remember and that can be said easily and quickly—such as by taking the first syllable of each name and saying "tuncar" or "tuncarb" tools, when speaking of Carboloy, Diamondite, Widia metal, or any other tools that may use tungsten and carbide as the main elements? It is much more simple than using the full name as we do at present.

Record Cards Tell the Story

"PICKING foremen," said Frank Fuller at the lunch table, "is a lot like buying an automobile. You listen to the good points as told by the man himself or by someone else, and you're mighty apt to pick the one that's advertised with the most adjectives."

"That isn't the way I buy a car, Frank," spoke up Dick Duncan. "No agent ever yet sold me a car. I make up my mind what car I want and go and take it away from them. They don't even deserve a commission."

"And how do you do that, Dick?" chipped in another of the party.

"I make a list of the features that appeal to me, such as the type of motor, clutch, brakes, transmission and all the rest, not forgetting oil filters and the like and the type of body. Then I pick the car that has most of the features I want. And I also consider the 'rep' of the maker because that counts a lot, too."

"Why isn't that a good way to pick foremen, Frank?" asked Bill Holland, our counsellor at large.

"Sounds all right, Holland, but just how would you work it?"

"Some plants I know keep a card file of every man in the shop. The foreman checks them up once a month and gives his impression of the various qualities of his men.

"These cards have a printed list of qualifications such as punctuality, accuracy, initiative, dependability, and so on. Each month the foreman gets a card made out with each man's name and he fills in the different items as he thinks best. These go to headquarters, and are used in selecting men for better jobs."

"Why a new card each month, Holland? Why not send back the old card and make one card answer for a year?"

"Just because that would tend to spoil the whole plan, Dick. The foreman would see what he had put down previously and be very apt to make the reports all alike. He'd think he had to be consistent. With a new card he puts down his last impressions of the men. And it's surprising how they vary from month to month.

"If a man has done a particularly good job within a few days he's very apt to get a higher mark than if it were done in the early part of the month, because we all have short memories. And a little slip just before the cards come around might easily wipe out the recollections of a splendid job a couple of weeks before. But they average out and give a pretty good indication of the way in which each man performs during the month."

"Seems like a lot of work, Holland," spoke up Fuller. "Might pay better to choose the wrong man occasionally."

"Those who use it don't think so. They figure that they get a high percentage of good men when they pick a foreman or a man for any special job. They don't depend on the foreman's last recollection of a man. And they feel that the effect on the morale of the whole shop makes it worth while.

"When you get the men in a plant believing that merit counts, that the records in black and white are a big factor in picking men for better jobs, you get a crew that averages a lot higher than where men are picked by hit-and-miss methods, as is often the case. The quiet, but efficient chap is more apt to get a 'break' where the records are kept on cards instead of in the foreman's 'head.'"

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Rewards for Suggestions

A suggestion system for shops is an excellent idea. After several years' experience with the plan in the shops of one of the railroads, I know that it has saved the company many thousands of dollars. When the idea was first suggested there was considerable opposition to it,

not only from the foremen but from the heads of the departments. The president put it across, however. The first suggestion resulted in a saving of about $650 annually and the employee was given $65. The reward given usually is 10 per cent of the first year's savings as a result of the suggestion. The minimum reward is $5. Frequently this reward is given to stimulate interest in the plan when the idea is hardly worth it. But what is $5, anyway, to the company if it stimulates a man to think?

There are eight or nine members on the suggestion board. Two of the members are workmen from the shops, who are elected every six months. The other members are heads of departments that would most likely be affected by the suggestions made. The suggestions are mailed in to the secretary of the suggestion board who, in turn, routes them to the head of the department affected, with a request that a thorough investigation be made of the possibilities, and a report made to the suggestion board, which usually meets once a month. At present, the suggestions are signed. A better practice is to give them key numbers. I have noted instances where personal animosity has tended to creep into the decisions.

—P. W. LAMSON.

Can Shop Losses Be Charged to Sales?

Many, if not most manufacturers believe that a satisfied customer is the best advertisement. Their slogan is "Service Plus," satisfaction to the customer at any cost. Many firms are beginning to agitate against free service. Yet, it still continues in another form. The making of special parts at a loss is just as much a free service as any other form of accommodation. These losses must be absorbed somewhere and somehow. Should they be charged to the overhead expense of the department making the parts, to sales expense, or to advertising?

Advertising is an expense incurred in the securing of sales orders, the same as salesmen's salaries, traveling expenses, and items of a similar nature. Ordinarily it may be defined as a form of selling by means of the printed word. But special service to the customer is just as much, and, in most cases, just as good advertising as the printed word; it aids the sales force in securing sales orders and in retaining the good will of the customer.

When a department makes special parts which aid the sales force in making sales, it is furnishing advertising copy in the form of replacement parts instead of printed words. Such being the case, the losses incurred in the making of the parts are certainly chargeable to selling expense under the head of advertising.

—R. H. KASPER.

Is the Shop the "Goat"?

The question of saddling items of sales expense on the factory brings up problems of sales policies, and raises a discussion as to the correct ratio between selling costs and shop wages. Shapers, lathes, planers, and saws can be made and marketed in comparatively large quantities, and the purchaser does not have to be sold on the idea that he needs such machines. Price and quality alone affect the greater part of the sales argument.

The sale of special machines, however, either single-purpose or large combined machines such as those used in automobile factories for finishing cylinder blocks in one operation, is far more difficult. A more expert salesman is required, and, as the demand is not great, his traveling expenses per sale will be very high. Often the sales cost will far exceed the total wages spent on the article.

In spite of this, however, I am of the opinion that, on the whole, engineering sales costs, especially in general lines, are not unduly high. Certainly, of recent years, intensive competition has seen to that. But the production superintendent is certainly correct when he suggests that the sales cost of 80 per cent, for which he is not responsible, should receive a scrutiny equal to that given his wage costs. Obviously, the actual sales expense involved is much greater than shop wages, and a small percentage reduction would have far greater effect.

—C. NORMAN FLETCHER, *England*.

Day Work or Piecework?

When managers and production executives claim that a bonus scheme is required to put men on their toes, or, in other words, to induce them to turn out a good day's work, we can be sure that they have not gone very deeply into the matter. If they will investigate carefully the question of output, before deciding to introduce bonus schemes, they may notice that workers are not producing all that might be expected of them, because they are unduly fatigued by inadequate equipment. Ungainly jigs and fixtures, absence of quick-change chucks, lack of an easy means to feed machines, and absence of chutes or conveyors to take finished parts away, are only a few of the many examples which we could cite from drilling, milling, and other manufacturing departments.

Regarding the mention of the Ford method of day-work payment, a scheme enlisting teamwork is in operation in two shops of which I know. Costs are collected and a work value is stated at which the plant is paying its way monthly. Once this point is reached, every employee is placed on an output bonus for extra work done. Such a plan seems to offer the squarest deal of all, both to the firm and to the men. —T. BONSALL, *England*.

Applying Navy Methods in Stock Control

By A. H. Rodrick
Industrial Engineer, Naval Torpedo Station, Alexandria

OLD-FASHIONED management knew little of stock control. The manager had little idea of how much he had until he took his annual, and only, physical inventory; nor did he know the amount of his gross profits until that time, when he figured what the stock had cost him and for what he had sold it. Under the scientific form of management there is no place for haphazard methods. The successful manager of today is the one who keeps his finger on his stock situation and by so doing knows his financial condition from day to day rather than from year to year.

A manager can control his stock status at all times without the expense of physical inventories by a perpetual inventory, and the following describes such a plan and explains its advantages. The plan is in use, and has been for years, at all navy yards and naval stations, where stock of all character, including bar, fabricated parts, plant and office equipment, and stationery, is carried in large quantities to meet the needs of the Navy afloat and ashore. The system, as well as the principle underlying it, is readily adaptable to any private business either industrial or otherwise.

STOCK CARD

Article										Stock or Identification Symbol or No.				Unit		
Location Building			Floor			Bay				Bin or Shelf No.			Low Limit			
Received						Expended							Balance			
Date	Inv. No.	From	Quantity	Price	Unit Price	Date	Reqn. Order No.	To	Quantity	Price	Unit Price		Quantity	Price	Unit Price	

A Navy perpetual inventory stock card applicable to almost any type of small shop

A record of all stock received, expended, and on hand is kept on a stock card similar to the one shown. In addition to being a means of controlling the stock situation it also furnishes a history of past purchases, expenditures, and the cost and sale price in each case.

In a large manufacturing plant each kind of stock usually bears an identification symbol, or a drawing and piece number, and is recognized by this designation rather than by its name. The stock on hand is so carried in the storeroom and is so ordered by the department requiring it. This is the most efficient method of identifying such parts, and the stock cards are filed accordingly, that is, by symbol or drawing number rather than by the name of the article.

Under the heading "Unit," on the card, is entered the manner in which the stock is carried, issued, or sold as the case may be, that is, by the piece, dozen, gross, box, bag etc. This also makes it easy for the stockman in charge to check the stores.

One of the greatest inefficiencies and a primary cause of some failures is being "overstocked." Stock on the shelves which is not moving is not only dead money but is constantly increasing in cost by the accumulation of compound interest. Many a firm loses money when it sells goods at an apparent profit because of interest charges on the capital invested over a long period of time.

At the same time he must keep on hand a sufficient quantity to meet the future and anticipated demands of the business. The information "low limit" helps in solving the problem. For each article there is determined a low limit and when the stock reaches this number more is ordered. The amount to be considered as a low limit is based on the factors of probable demand and time consumed in procurement as shown by the stock records, and may have to be revised from time to time to meet changed conditions.

With such a system in use the purchasing agent is not required to keep constant watch over his stock to prevent shortage, for the stockman knows the low limit of each piece and when that figure is reached he notifies the proper authority that more should be ordered. The low limit is not discovered casually, as in the case of stock-taking, or by circumstances, but is known at all times through the instrumentality of the perpetual inventory.

The columns under the heading "Received" furnish valuable statistical information, and provide a guide for future purchases. The purchasing agent is thus enabled at a glance to see from whom he has been receiving satisfactory material and the price he has been accustomed to pay. The unit price is essential because when material is drawn out it must be issued at a unit price for cost accounting purposes. It also furnishes comparative prices for the use of the purchasing agent.

The columns under the heading "Expended" furnish the same relative information as those under the heading "Received." The two taken together afford a quick and accurate means of determining the gross profits on sales. From the total gross profits can be deducted the cost of doing business and the difference is the net profit or loss.

The columns under the heading "Balance" not only show the actual stock to be accounted for but the amount of capital represented thereby.

In every business or industry of more than one department all stock should be concentrated under one head who shall make all issues and be solely responsible for its custody. In well-regulated establishments a central correspondence file is maintained, and the employment and maintenance of labor is vested in a personnel director. There is no logical reason why so costly a branch of management as stock should not receive at least like consideration. If one department purchases when another has the same material on hand, it is obvious that overlapping and duplication exist which is both poor and expensive operation.

Gear Work in a Jobbing Shop

By George S. Brady
Associate Editor, American Machinist

Methods employed in a typical contract shop specializing on gears in getting work and handling the shop and personnel

Fig. 1—One end of the machine room of a contract shop specializing on gear production
Group motor drives are used, and every machine employed in the shop is modern. A large space is reserved at the forward end for receiving and cutting up bar stock, but no material nor parts are stored.

CONTRACT gear work is a specialized business. The work bears no relation to that of the ordinary "jobbing shop" that takes on an order for gears and makes them up on a milling machine, and on the other hand the contract gear shop does not compete directly with the production gear manufacturer who makes regularly a wide variety of sizes and types, and who stocks all of the standard gears. Gear contract shops are located in many of the chief industrial centers and are likely to have a limited radius of sale. There are exceptions, however, where the shop serves a particular industry over a wider area. Their flexibility in personnel and equipment gives them a certain advantage in bidding on special gears or on small miscellaneous lots of gears, so that they are able to take over advantageously the gear work for machinery manufacturers who do not find it economical to equip for this work. A typical shop of this kind, in which modern equipment has played an important part, will be described in this article.

The gear contract shop of the Sier-Bath Company, which may be considered as typical, is located in the heart of the city of New York. It serves primarily a field consisting of the manufacturing plants in greater New York, and its city location gives it access to the large dealers who carry stocks of steel and other materials and supplies.

The shop is located on the street floor, and is laid out for convenience and progressive manufacture. Delivery trucks can enter at one side of the shop and deposit the bar stock alongside of the power saws, or the castings in the receiving end of the shop. No stocks are kept of any raw materials except those required for tools. The office and the toolroom are located on the street front, and the machine shop extends the full length of the building in the rear. The heat-treating department occupies a separate room in front alongside of the entry and delivery door.

The first problem of the gear contract shop is to adhere closely to its own line of work and keep an even balance of jobs ahead. It has been found by experience in this shop that orders must be kept ahead for a period of from 4 to 6 weeks for efficient operation. This means that orders are taken on a 4 to 6-weeks' delivery basis, except occasional rush jobs that can be worked in without upsetting regular schedules. Longer delivery dates are not desirable to customers. On the other hand, with work that requires considerable time in process in the shop, an even flow of work to the machines can only be secured by having a considerable number of jobs ahead without necessity for rushing them from machine to machine. In this way the machines are kept occupied over a maximum proportion of the time, and it is pos-

sible to use the skilled men where their time is of greatest service. With this system in operation it has been found possible to keep all machines busy 75 to 80 per cent of the time, or in other words, to operate the shop on an excess machine capacity of only about 20 per cent, which is admittedly low for a contract shop.

The organization of the shop is that of the normal small shop, in which the owner acts as general manager and shop superintendent, and one general foreman looks after the details of assigning work and following the orders in the shop. All of the shop employees are skilled men requiring little supervision and capable of handling the great diversity of work undertaken by the plant. The general foreman is also responsible for the quality of the output, and he supervises the product inspection. All work is given 100 per cent inspection by a skilled man in the toolroom. One man is required on the outside at all times to keep in touch with customers, contract for new work, and keep the orders balanced.

This Shop Believes in Modern Machinery

It is a principle of this particular shop that no contract shop can compete for the best jobs in the open market on the bases of high-grade work, competitive low price, and quick delivery without the most modern machinery equipment. The shop has an assortment of screw machines, turret lathes, universal boring mill, gear shapers, thread millers, key seaters, and universal milling machines. It designates a definite range of work from 1 in. to 26 in. in diameter, but in special cases takes work outside of this range. Where a gear larger than 26 in. is called for the contract is always made that the customer furnishes the gear blank turned. This avoids the necessity for sub-contracting, which is apt to lead to difficulties.

Usually the customer furnishes the castings that are to be cut into gears, but the shop has contracts and agreements with foundries where it can obtain castings in all commercial metals. Where the contract shop furnishes the castings or raw material a handling charge and service charge are added to the cost as charged to the customer. All raw materials, including castings, that are procured by the contract shop are given a physical test to insure service quality. Physical tests are usually more expensive than chemical or laboratory tests, but are considered by the shop as more practical and giving a better idea of the action of the material in service.

The heat-treatment to be given the gears is sometimes specified by the customer, but more often it is left to the judgment of the contract shop. The heat-treating room is in charge of a specialist. Gas furnaces are used, and the treatment depends on the class of steel and the finished requirements of the customer. After heat-treatment the gears are inspected by the inspector under the general foreman. The inspections are visual and for hardness.

The control system for a job shop of this kind is comparatively simple. The orders are made out in duplicate, the original being kept in the office and the copy going

Fig. 2—Heat-treating is done by a specialist in a separate room. Pyrometer control is used. The work comes to the heat-treater in separate lots properly marked. This workman is under the direction of the general foreman

to the shop. The original serves as the cost sheet, and the time is copied daily on the reverse from the workmen's time cards. Material costs are simplified by the fact that the stock for each job is ordered especially for that job, or else comes in with the order. The customers generally furnish blueprints of the finished

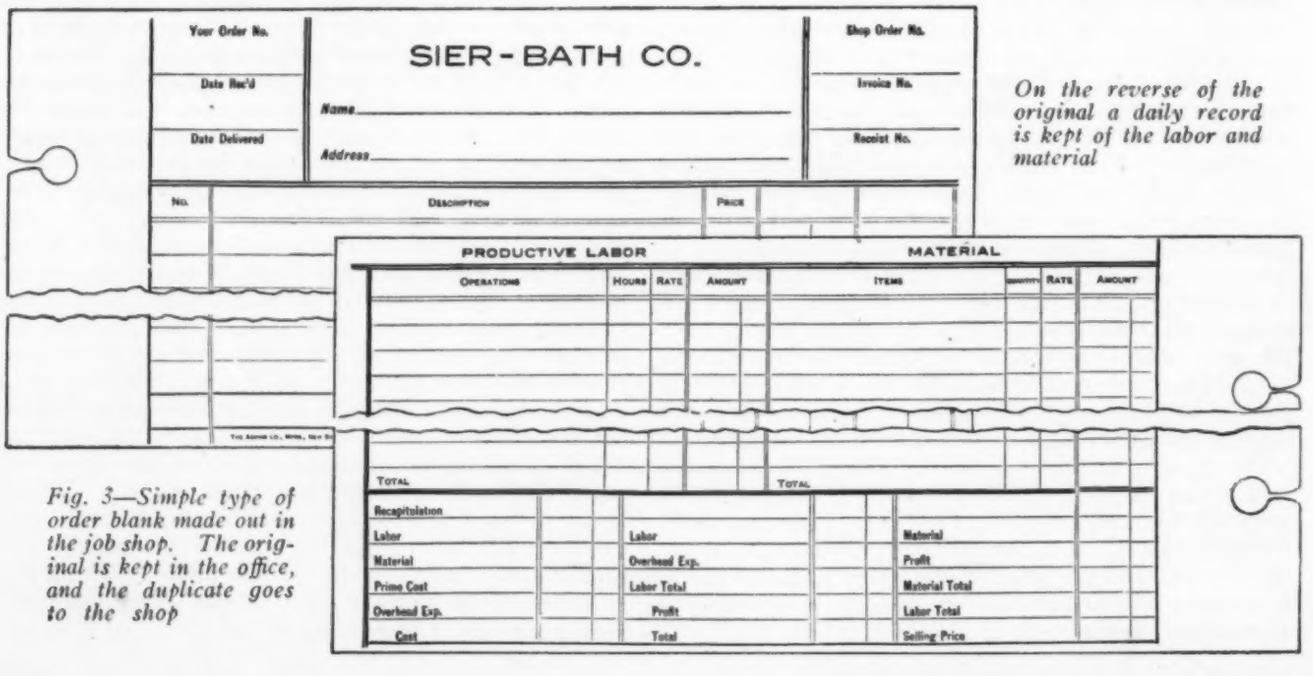


Fig. 3—Simple type of order blank made out in the job shop. The original is kept in the office, and the duplicate goes to the shop

On the reverse of the original a daily record is kept of the labor and material

product. A small drawing room is attached to the office where sketches or detail drawings can be made up by the shop superintendent or general foreman.

Possibly the most remarkable feature of the small shop, of which this gear plant is a type, is the unity of organization and close attention to detail that is possible by the co-operation and interlocking of duties. Every contract job taken in is given individual attention. It is known to, and supervised by the manager, superintendent, and foreman. The general foreman is responsible for the work from the raw material to the final inspection, including responsibility for any special tools required in the machining. The outside salesman is close enough to manufacturing methods to be able to bring back to the shop details of the reasons why a contract has been lost to another shop. He is one of the factors in the small shop in promoting the urge to install high-production equipment and better methods. Purchases are made by the manager, although they may originate from the shop. The labor turnover is practically zero, almost the only changes in personnel in 15 years having been increases in the number of workmen.

Unlike the average job shop, this gear plant requires specialists and does not attempt to operate any kind of an apprenticeship system. Boys are taken on occasionally and are gradually taught the various operations of the shop, but no special time is set for their training. Ordinary maintenance jobs, such as repairs and oiling, are done by men giving part time to this work. Much of this class of work is done outside of the regular working hours of the shop.

Fig. 4—There is no formal inspection department in this class of small shop, but every gear is inspected by a man in the toolroom before it is checked out for delivery

OTHER articles which have already appeared in this series on contract shop work were published as follows: Meeting the Problems of the Contract Shop, Vol. 68, p. 608, Vol. 68, p. 717, Vol. 68, p. 815; A System for Handling Heavy Contract Work, Vol. 68, p. 1047; Heat-Treating on Contract, Vol. 69, p. 523; Heavy Contract Work in a Southern Shop, Vol. 69, p. 163; Plating and Finishing on Contract, Vol. 69, p. 589; Heavy Work in a Southern Contract Shop, Vol. 70, p. 744.

Safety Devices Cheaper Than Compensation

By K. Rankin

IN THE state of Wisconsin one clause in the workmen's compensation act is to the effect that in a compensatable case, an injured employee is entitled to compensation indemnity of 15 per cent more than the amount otherwise provided, if in fact his personal injury occurred from accident-producing conditions [hazards] existing in violation of the state safety laws and safety codes. Primary liability for the additional compensation rests upon the employer and not upon his insurer.

During 1928, a total of 17,826 claims for insurance were paid for industrial accidents in the state, and in this group 387 separate employers paid extra compensations of 15 per cent. Actually, there were 445 cases of safety code violations, so that 92 per cent of the 387 separate employers had but one case of liability for increased compensation. The amount of increased compensation due to violations by the employers amounted during the year to $36,534.49, while the total amount of compensation paid during the year was $275,208.24.

An Analysis of Extra Compensation Payments for Industrial Accidents in Wisconsin, 1928

Condition Involved	No. of Cases	Total Compensation	15 Per Cent Increased Compensation	Cost Per Violation
Power presses, guards	123	$68,144.64	$8,891.23	$554
Power presses, trip device locked	1	165.44	21.58	165
Gears	35	17,386.81	2,271.39	497
Eye protection	10	10,596.72	1,382.19	1,060
Pulley guard	2	8,449.47	1,102.11	4,225
Emery wheels, hoods, and guards	1	80.21	10.46	80
Shafting	3	1,968.83	256.81	656
Covering shafting	2	1,870.85	244.05	935
Key and keyseat sprockets	1	1,566.16	204.28	1,566
Belt shifters	1	234.57	30.60	235

The accompanying table is of interest to the metal-working industry, for it shows violations occurring where equipment used largely in the metal-working industries is involved. It should be noticed that punch presses were the chief cause of violation as well as representing the highest financial expense, namely 124 cases involving $68,144.64. Next in order of importance in the metal-working industry comes gears, there being 35 violations involving $17,386.81. The added compensation amounted to $2,271.39. The protection of eyes, involving 10 violations, costing $10,596 with $1,382 extra compensation is third in order.

The last column, showing the prorated cost per violation, shows that the cost of individual guards for presses and gears, goggles for eyes, or other protective devices, is out of all proportion to the cost per accident—or per violation. In fact, in most of the cases cited the 15 per cent penalty borne by the employer would more than pay for the protection called for by the safety code. In other words, the employers, financially, would have been considerably ahead, had they adopted the safety appliances at the start instead of having to pay 15 per cent additional compensation as the result of accidents, especially when it is realized that ultimately they were compelled to adopt the safety code in any case.

"Safety First" pays, and the employer who foregoes the adoption of safety practices pays for them over and over again without having them, as well as paying for them through labor turnover, and curtailed production.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Should Workers Buy Company Stock?

"I GUESS you made out pretty well with the bonus you got last winter, Al," said Ed as he dropped into Al's office during noon hour and saw the morning paper open at the stock quotations. "Gave the old bank account a chance to fatten up so you could do some gambling on the street, didn't you?"

"Well, the extra money sure did come in handy. I didn't blow any in on stocks, but it all went anyway. That seems to be the grief of the men in the shop who got extra money for overtime. They spent all they got without anything now to show for it."

"What of it? Every man was paid for the time he put in, and has a right to do as he sees fit with his money."

"Well and good, Ed. But if it's all gone nobody will get a head start on the new plan Williams says he is going to bring up at the next foreman's meeting."

"What plan?" asked Ed.

"Why, this idea of a share in the business. Subscribing anything up to ten per cent of your pay to buy company stock, and getting a dividend check every six months."

"I don't think that will go over," grunted Ed. "If Williams tries to tell the men what to do with their money, I'm afraid some of the experienced fellows are going to quit. Deducting five or ten per cent from the pay envelope, even for an investment, is going to cause hard feelings."

"That's not the way to look at things, Ed. It didn't go bad with Liberty Loan subscriptions, and why should it in this case? The company's going to expand, and rather than sell the stock on the open market, the big chiefs want to give the men themselves a chance to share in the profits."

"But you won't get any new men to take a job under a plan if they earn, say forty dollars a week and get only thirty-six in the pay envelope. It's the pay envelope that counts."

"Say, Ed, can't you see the company is opening up a way for the men to save money they wouldn't ordinarily lay aside? Then, if a man is laid off or quits, the company will buy back his shares at full value. Anyway, a fellow won't feel so much like quitting when he's got a financial interest in the business, and he'll do better work."

"Maybe he will feel more like getting out. In a few years when he has a few hundred dollars saved up, he may want to quit to get the money. He sure would quit if the company had a bad year and passed up dividends, and if it failed he'd lose his savings."

"Well, anyway, Ed, those are the chances you take with any company when you buy stock and become a capitalist."

Is Al right in saying that men will save money they would not ordinarily lay aside, if they have a chance to buy company stock? Do you agree with Al that they will stick to their jobs and do better work? Will new men hesitate to take jobs?

Contributed by Morton Schwam

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Stirring Up the Foreman on Accidents

THE prevention of accidents must be in the mind of everyone, constantly, in order to be successful. Many valuable suggestions, rules, ideas and instructions are received from insurance bulletins and the pages of the industrial press, but after all, it is up to the management to keep everyone on their toes and prevent accidents. Every department head of the Hoyt Electrical Works receives a bonus at the end of each month if no accidents have occurred in their respective departments. In addition there is a safety committee whose duty it is to go into all matters pertaining to safety, and to make an inspection of the plant once a month, and the power press department each week.

A foreman who did not enthuse, and pay attention to safety requirements and accident prevention would soon find himself in disfavor. Any employee removing a safety device without authority is given a lay-off. And if a guard or safety appliance is removed to perform some work that cannot be done with it in place, instructions are issued to the employees affected and the matter is handled by the foreman concerned.

—CHARLES H. WILLEY, *Asst. Plant Supt.*,
Hoyt Electrical Works.

HARD as it may seem, the foreman is responsible for the accident record of his department. I have been associated with the safety movement for ten years and during that time I have seen the importance of the department safety committee man gradually decrease and the position of foreman increase correspondingly in the safety movement. And this is rightly so. Records will show that 95 per cent of all lost time accidents are man failures, and only 5 per cent are accidents caused by poor equipment or by failure of machines.

I have been a foreman, and have seen gratifying results come from making the foreman responsible for the accident record of his department. Therefore, I suggest that this practice be continued. If the foreman is capable and a good executive, he will broaden out to the responsibility placed upon him and accept the challenge.

—CHARLES M. CLARK, *Sales Dept.*,
Cincinnati Milling Machine Company.

An Unemployment Fund

PROVIDED that adequate safeguards are introduced to keep collected funds intact, there is a great deal to be said in favor of giving the experiment a genuine trial. Any practicable scheme will have to be run on a voluntary and a contributory basis. The company's aim, of course, will be to make the scheme so attractive that workers will be anxious to participate. The company's contribution should include free administration and direction, and a reasonable annual subscription.

There are advantages to be derived from a method which considers each year as a year apart. The amassed contributions for a year should form the available funds for that year. A reserve should be built up by allocating a certain percentage from each year's revenue. At the end of the year, what moneys remain should (apart from the reserve already ear-marked) be divided among the members. The company, too, should pay a reasonable interest upon the funds entrusted to its care.

Such contributors as leave or are discharged during the year should receive their proportion of the fund, less any benefit they may have received, plus interest.

The suggestion outlined is a variant of a sick-benefit club run by the staff of an electrical engineering company. The grants cover at least four weeks' payment where necessary. At the end of each year the balance of the funds, if any, is distributed among the members.

—W. ROLAND NEEDHAM, *Engineer,*
Design Dept., English Electric Company, Ltd.

Should We Buy Tools by the Pound?

ED'S objection to a cost of $500 a pound for tool steel is natural enough, but it isn't reasonable. In terms of material it is exorbitant according to all our preconceived notions of value. On the storehouse shelf it certainly isn't worth any such value, but if we make use of it for the purpose for which it was developed, it ceases to be material, and becomes a tool. When we regard it as a tool, it is worth to us exactly what it will give us in production. No one ever thinks of buying machine tools by the pound, yet that's exactly what this new alloy is. We have learned to accept the fact that a precision bench lathe costs more than a full-sized engine lathe. If weight was a standard of value, many a new modern machine would be worth less than its obsolete prototype. So I heartily agree with Al that only results count.

—WILLIAM J. KANE.

Going Over the Super's Head

GOING over anyone's head is always a "ticklish proposition." It is well to consider carefully, and weigh all the facts before undertaking such a step. For after all, discipline and the maintaining of good order demand the use of established channels.

If, however, careful analysis confirms your decision to press your suit to the highest court, then you owe it to yourself to carry on. Since your motives must be beyond question when you decide to undertake such a step, you must reflect this in the manner in which you handle the matter. Underhand methods are not fair.

Therefore, if you are going to take up with the gen-

eral superintendent, a matter on which the super had turned you down, it is only fair that you notify the superintendent of your intention. Your case must be based on facts, and is doomed to failure in advance if you weaken it by giving vent to your personal feelings in presenting it, and no matter what the decision may be it is imperative that the matter ends there as far as you are concerned. —JOHN F. HORRISBERGER.

Going Over the Super's Head

BEFORE any man is competent to control others, he must first learn how to control himself. He must also have an elementary knowledge of teamwork in a sportsmanlike sense, so that he can use, and make useful to others, any human material given him to mold and teach. Black seems to be deficient in these qualities, and before his ideas, which may be good and useful, can be used profitably, he must first learn the fundamentals of his own job, one of which is not to interfere with another's. Then, he can put forward any idea which supplements his own work and he will not be the "problem" which he is in the present case.

—ARTHUR BRAMWELL.

Re-Hiring Old Employees

REAL loyalty should always be given the most careful consideration, but lack of courage to step out and better one's condition when there is an opportunity should not be construed as loyalty, and the fact of this inherent weakness to allow valuable opportunities to pass, should not be overlooked.

Where other conditions are equal, or even where they may slightly favor the outsider, it would seem that the man already employed should receive the promotion. On the other hand, in organizations where seniority rights are strictly observed, many misfits occur due to the fact that incentive is lacking. The feeling prevails that all that is required is to give service sufficient to prevent discharge and maintain a fair standing, that promotion cannot be diverted from its regular channel, but will come in due time in the regular course of events. Such a policy does not encourage ambition.

—JOHN MARK MAY.

Letting a Big Order Go Elsewhere

WHEN a plant is working to capacity during the ordinary hours there are only three ways of increasing production, overtime, running an extra shift, or adding to the equipment. For a case involving temporary pressure of work the first two are usually the only alternatives. If working overtime for three months would have met the customer's delivery needs the order should have been booked, because in this case no extra hands would be needed. If overtime would not take care of the matter, running an extra shift always merits consideration. Often, wages are somewhat higher, but this is generally more than offset by the saving in overhead charges. Of course, the new men will not be so skilled at first as the regular employees, but a leaven of the latter should be put in the new shift, and temporarily replaced with new men in their own.

—C. NORMAN FLETCHER, *Cheshire, England.*

Keeping Posted on New Tools

WITH so many revolutionary changes taking place in methods and tools, it becomes more than ever necessary that foremen and machine shop men, generally, should keep pace with new ideas. They can only do so if they are encouraged to read, and are given access to the various technical magazines which enter the plant.

In one plant with which I am acquainted, the men have a recreation room where they can eat their lunch and spend the meal hour. The management keeps it well stocked with the latest trade magazines. Not only this, but the superintendent reviews the various journals and calls attention to any article of particular interest through a notice posted on the bulletin board. The many discussions and queries which these articles evoke, show that the men are alive to the possibilities of the scheme. —R. S. ALEXANDER.

* * * *

THE · NEXT · TOPIC

"Radio in the Shop"

Shall Men Clean Their Own Machines?

Summary of the Discussion

Al told Ed about a factory Williams had visited, where a cleaning gang cleaned all machines, using a steam jet. Ed objected to a cleaning gang in general, and had doubts about the efficacy of steam for cleaning purposes. Al admitted that there is room for an argument but prefers the cleaning gang, and cited instances to prove his contention.

THE opinions as to whether the operator should clean his own machine or whether a cleaning gang should do it were about evenly divided. A machine shop instructor held that he was unable to get away from the idea that a good workman was interested in his work enough to take care of his machine, and that he instructs the boys under his charge that this is the proper procedure. Another contributor claimed that pride of possession does not mean a thing to the average mechanic, and that they are not interested in cleanliness. He therefore favored the cleaning gang. A foreman contended that machines should be kept clean all of the time, because of the effect a neat looking shop has on possible customers. One contributor from Canada said that a man should clean his own machine during working hours, but if he happens to be a piece-worker, a time study should be made and a price set. From Mexico, the head of a government shop wrote that he had tried several methods, none of which were entirely satisfactory. He finally decided upon a cleaning gang composed in part of maintenance men. Cleaning with steam did not meet with favor.

Aluminum-Alloy Parts *in Machine Construction*

By George S. Affleck
Metallurgist and Director of Research
Aluminum Industries, Inc.

Because of its light weight, low machining cost, and superior strength to cast iron, aluminum alloys are being used for all kinds of machine parts

SHEER engineering merit has caused the adoption of aluminum alloys for many purposes other than aircraft and automotive construction. Lightness and resistance to corrosion have always influenced their choice, but now an alloy exists for virtually any purpose, whether the requirements be for greater stiffness, ductility, resistance to shock, or fatigue, high-tensile strength, or relatively great hardness and resistance to abrasion. In fact, the entire transportation industry is turning to the use of aluminum alloys for the purpose of decreasing the dead load and increasing the pay load. High electrical conductivity has caused its adoption in the electrical industry. Its strength and lightness have found new applications in the textile industry, in the production of artificial silk, where high-speed spinning tops made of aluminum alloy have reduced vibration and bearing stresses due to minute degrees of out-of-balance.

Cast aluminum-alloy propellers for ventilating blowers are now being used extensively. These propellers vary in size from small household units to large man coolers for use in steel mills. Their high efficiency, low power consumption, lightness, absence of vibration and resistance to corrosion are largely due to the alloy used. Baking-machinery castings for dough mixers, cream whippers, kettles and vats, are now either cast or formed from aluminum alloy. Portable electric drills and grinders owe much of their popularity to their lightness, made possible by the use of aluminum alloy.

Gradually, the other mechanical fields are being tapped. When we consider the advantages to be gained from the use of these alloys, we wonder why their adoption in certain industries has been so slow. Usually, the complaint is regarding the high cost of aluminum and its alloys, without any consideration of the advantages arising from its use, or the net decrease in cost due to less actual weight of material used. The saving in machining costs will often balance the increased cost of the metal used. Also, the salvage value is several times that of iron or steel. The decreased weight of reciprocating parts reduces vibration and power consumption, and this same reduction in weight is responsible for the smooth running of rotating parts by minimizing the effect of improper static and dynamic balances.

When we compare the strength of aluminum and its alloys with iron and steel, on a pound for pound basis, the advantages are much more apparent. Iron and steel have specific gravities of about three times that of most light aluminum alloys. It is not modest to say that cast iron has a tensile strength of 30,000 lb. per sq.in., while it is very conservative to assume the same figure for heat-treated, light aluminum alloy. On this basis, a bar of aluminum alloy having the same strength would weigh but one-third as much as cast iron, or one having the same mass would withstand a load three times as great. The maximum Brinell hardness of heat-treated aluminum alloys rarely exceeds 140, which is near the minimum for cast iron.

A maker of gear shapers uses aluminum-alloy castings for the internal working parts of the machine to cut down the inertia. The author of this article believes that these alloys have an increasing application in machine tools as well as in other machines for light moving parts

A large manufacturer of oil and gasoline pumps has recently adopted permanent-mold castings of aluminum alloy to replace parts formerly made of cast iron and bronze; see Fig. 1. The production in permanent molds gave castings that were accurate as to dimension and manufacturing tolerances, thereby cutting down the machining operations to a minimum. The pistons were formerly made of cast iron, and had to be cadmium plated after machining to prevent corrosion. Pin holes in the plating caused this protection to be not very effective, so that it was not unusual to overhaul pumps with the pistons stuck in the cylinders. The valves were of the floating type, and were made of bronze, cast in sand. Decreasing their weight was a great advantage.

A manufacturer of printing machinery uses permanent-mold, cast-type aligning blocks, one of which is shown in the rough in Fig. 2 and in the finished state in Fig. 3. Their low specific gravity reduces the weight of the loaded chase. Freedom from corrosion, low machining cost and great strength influenced the choice of an aluminum-copper-zinc alloy for this purpose.

Manufacturers of paint-spraying equipment have found it desirable to reduce the weight of their equipment, which must be frequently lifted or moved from place to place. Spray-gun handles of aluminum alloy,

cast in permanent molds, are light, strong, and are not porous, as were those formerly cast in sand. Covers for pressure tanks that must withstand pressures up to 100 lb. per sq.in. without leaking, are made of aluminum alloy.

In selecting alloys for various purposes, the informed engineer will not be confused by high-sounding names often ending in "ite." No alloy owes its properties to its name, and a mere chemical analysis does not mean everything. It is well to first decide which casting method is to be used in producing any particular part. At present, there are three methods in use commercially, sand casting, die-casting and permanent-mold casting.

The greatest tonnage of aluminum-alloy castings is, of course, produced in sand, and this method is indicated where the parts are large, require complicated coring, or where a limited number of pieces is required. Die-castings are used where a large number of castings are wanted, and where very close tolerances as to dimensions are required. Die-castings are mechanically weak, due to the fact that they have very porous interiors surrounded by very dense skins on the outer surfaces. Permanent-mold castings are used, where castings are required in reasonably large numbers. Castings made in permanent molds are sound, both internally and externally, and are very accurate as to dimensions. They have the greatest mechanical strength of castings produced by any method.

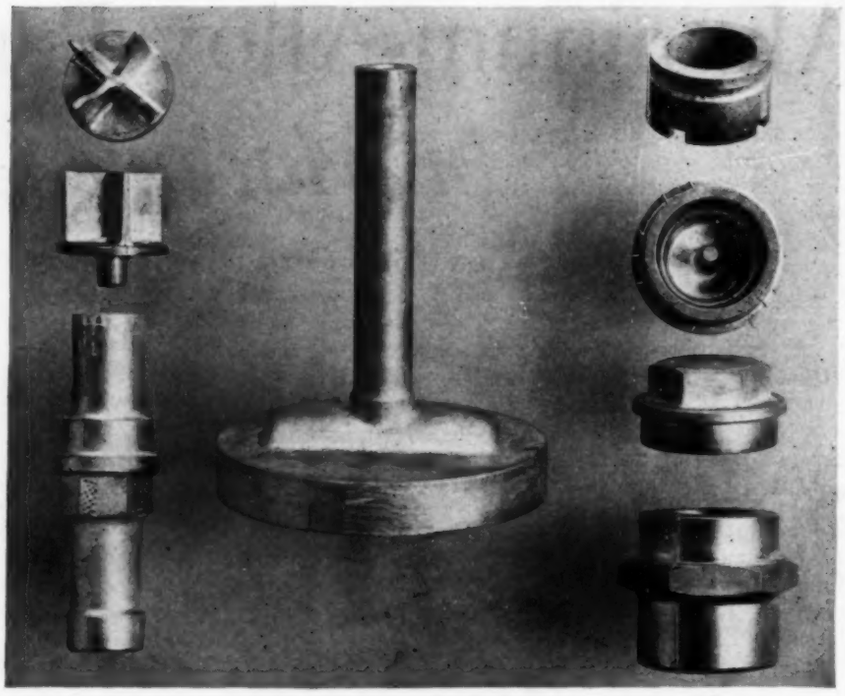


Fig. 1—Parts of oil and gasolene pumps made of aluminum alloy

Much of the data concerning the physical properties of various alloys are confusing because much of them are incomplete. The strength, elongation, hardness, resistance to shock and fatigue, or repeated stress, are not always stated for the various conditions under which a casting can be produced. As an example, an alloy cast in a permanent mold and properly heat-treated, can have a tensile strength nearly 100 per cent greater than the same alloy cast in sand and not heat-treated. Although the heat treatments for all aluminum alloys that are amenable to heat treatment are strikingly similar, each type of casting and alloy demands a slightly different procedure. The mere fact that past attempts to substitute aluminum alloy for other materials met with failure, does not imply that future efforts in the same direction must also fail. Great advances have been made during the past few years, and much greater progress can be expected in the future.

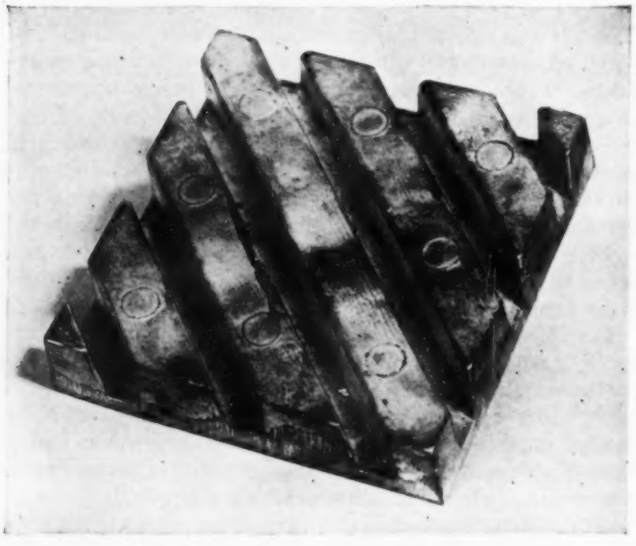


Fig. 2—Casting for cast-type aligning block made of aluminum-copper-zinc alloy and cast in a permanent mold

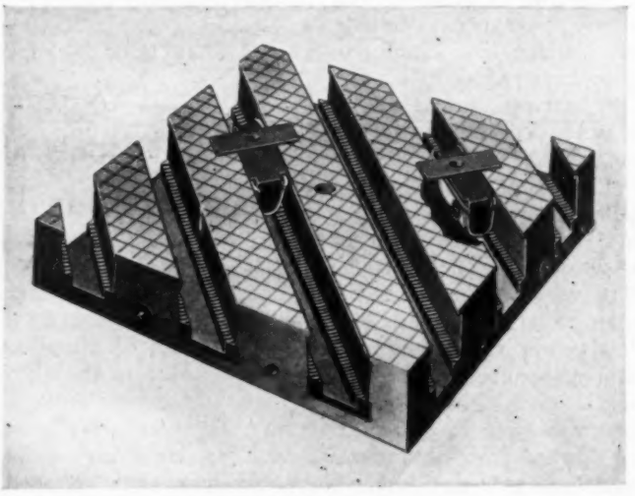


Fig. 3—A finished aligning block

Nearly 5,000 suggestions were received and considered by the Submarine Board appointed by the Navy after the S-4 disaster. These varied widely both in scope and in practicability, but they show the interest in the subject and that there is no dearth of ideas, whatever their quality.

Relieving-Tool Corrections for Formed Milling Cutters

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

The simple corrections for radial cutting flutes can be applied to relieving tools for hooked cutters by offsetting the relieving tools a predetermined amount

IF AN irregular form is to be produced either on a helical fluted milling cutter or on a skiving tool to be used in a lathe, where extreme accuracy is not required, the form of the relieved surface on a radial plane of the milling cutter or on a perpendicular plane of the skiving tool may be established by a very simple layout. The effect of introducing helical gashes on a milling cutter or an angular face on a skiving tool is exactly the same and introduces a straight-line angular distortion. Thus if the required profile is drawn to rectangular co-ordinates, the desired form, using the same co-ordinates for each point, would be plotted to angular ones, as shown in Fig. 6. For relieved form milling cutters, the x-axis is at an angle equal to the distortion angle as given by equation (1). For skiving tools, when

α = angle of relief
ϕ = angle of cutting face (which corresponds to helix angle of milling cutter flutes)
Δ = distortion angle

$$\tan \Delta = \tan \alpha \tan \phi \qquad (13)$$

The example used is the form for a handle for a handwheel. As a matter of fact, skiving tools would be more widely used on screw machines for the production of many formed parts were it not for the present expense and difficulty of making them. Their use makes possible the smooth finish turning of relatively long profiles in a single operation.

To produce such tools directly, the most useful form is that of the intersection of the relieved surface of either the relieving tool for the milling cutter or the relieved surface of the skiving tool with a plane perpendicular to the relief. In this case the layout or plotting process is exactly the same as before except that the y-co-ordinates are foreshortened because of the relief angle of the tool and the distortion angle becomes Δ' as given by equation (3). Thus when

y = co-ordinate of desired profile
y' = co-ordinate of profile on relieved surface of tool
α = relief angle of tool

$$y' = y \cos \alpha \qquad (14)$$

These foreshortened values of y' may be obtained readily by the use of proportional dividers set to the proportion of 1 : cos α. These forms can be laid out on metal templets or on the tool itself as may be desired. At the bottom of Fig. 6 such a layout is shown.

It may be of interest to remark that these simple geometric relations between the desired form on the work and the distorted form on the relieved surfaces of tools makes it possible to construct a pantographic fixture for use on a grinding machine—or a special grinding machine if desired—so that with a templet of the required form it is possible to reproduce this form directly for use as a gage, and also from the same master templet to grind directly the distorted form required on any tool to compensate for relief, helical flutes or angular cutting faces.

All of the foregoing distortions and corrections discussed relate to cutters with radial cutting flutes and are mathematically exact. When we study the form of the relieved surfaces of milling cutters with undercut flutes, however, we find that if the form produced is to remain exactly the same, the form of the relieved surfaces must change as the diameter of the cutter changes, so that an exact form, mathematically, cannot be found. We can, however, use an approximation in which error will be very much smaller than the probable error of execution in making the tools, hardening errors, or errors in resharpening the tools. As a matter of fact, in most cases, this mathematical error will be so small, usually in the fifth or sixth decimal place of an inch, that it cannot be detected, particularly if there are curves on the form.

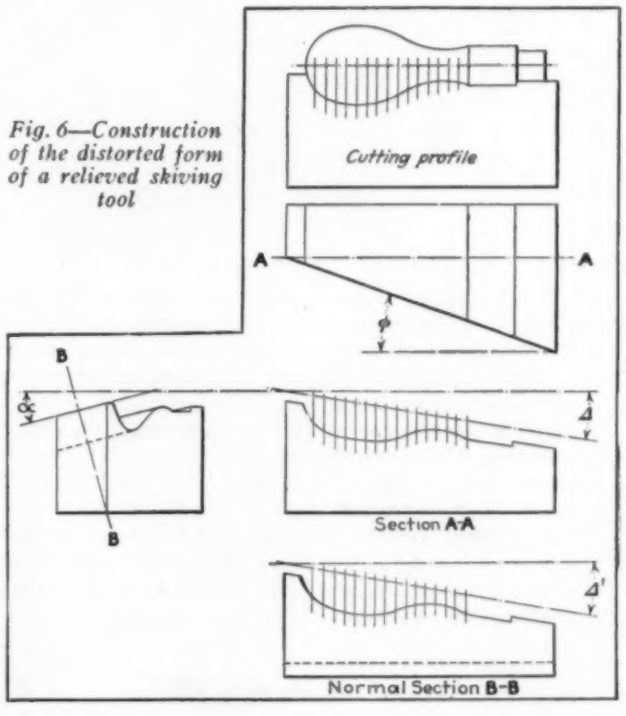


Fig. 6—Construction of the distorted form of a relieved skiving tool

The conclusion of the article.

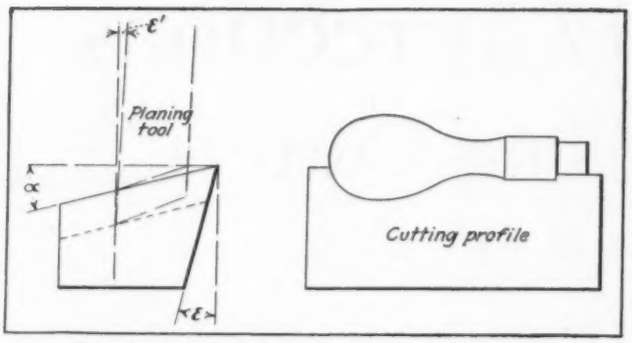


Fig. 7—Planing the contour of a skiving tool having a rake angle ε

It is possible, however, to make a mathematically correct modification for the distortion due to the rake angle on a skiving tool, so that we will first consider this problem and then discuss the approximate corrections for milling cutters with similar cutting flutes. For the sake of simplicity we will deal first with cutters with straight flutes, and then introduce the combined corrections for angular and undercut flute conditions.

In Fig. 7 is shown a straight tool for the same handle as before which may be used either as a planing tool or passed under the center of the work in a lathe to produce the form. In this example when

α = angle of relief
ε = rake angle or angle of hook
y = co-ordinate of required profile
y'' = distorted y-co-ordinate because of rake.

$$y'' = y \cos \alpha \, (1 - \tan \alpha \tan \varepsilon) \qquad (15)$$

It is of interest to note that when the hook angle is reduced to zero, this equation (15) becomes identical to equation (14). If we have a forming tool with a flat cutting face whose profile of cutting edge is of the required form, we can use this tool to plane the distorted form by tipping this cutter to a predetermined angle. Thus when

ε' = angle to tip planing tool to correct for rake

$$\cos (\alpha + \varepsilon') = \cos \alpha \, (1 - \tan \alpha \tan \varepsilon) \qquad (16)$$

This is shown in Fig. 7. In this example, the same tool that would be used for planing another tool with a flat cutting face can be used to plane one with a rake or hook, without introducing any mathematical error, by tipping the planing tool to the correct angle.

If it is desired to lay out this form directly, the proper y''-co-ordinate is given by equation (15). If proportional dividers are used, they would be set to the ratio of $1 : \cos \alpha \, (1 - \tan \alpha \tan \varepsilon)$.

If the cutting face of this undercut tool is to be at an angle so that it may be used as a skiving tool, the correct form, normal to the relieved surfaces, would be obtained by plotting the co-ordinates to the distortion angle as before, but using the value of y'' instead of the value of y' as before.

On milling cutters, an extremely close approximation to the correct form will be obtained by setting the same relieving tool which is used to produce radial fluted cutters a predetermined distance above the center of the cutter. This applies equally to cutters with straight flutes or those with helical flutes. In this case, referring to Fig. 8, when

R = radius to middle of profile on cutter, in.
h = distance off-center of hook flutes, in.
α' = angle of relief on milling cutter
ε = angle of hook on milling cutter
s = amount above center to set relieving tool, in.
N = number of flutes
E = radial relief per flute, in.

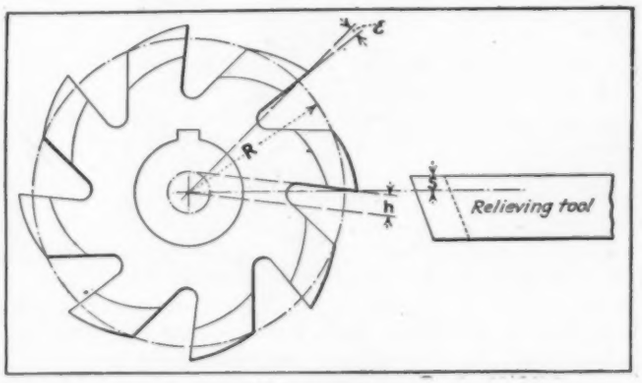


Fig. 8—Method of setting the relieving tool above center to correct for rake angle of milling cutter

$$\tan \alpha' = \frac{NE}{2\pi R} \qquad (17)$$

$$\varepsilon = \frac{h}{R} \qquad (18)$$

$$\cos (\alpha' + \varepsilon') = \cos \alpha' \, (1 - \tan \alpha' \tan \varepsilon) \qquad (19)$$

and therefore

$$s = R \sin \varepsilon' \qquad (20)$$

This setting is shown in Fig. 8. Thus the same relieving tool may be used to relieve either radial-tooth cutters or hook-tooth cutters by a suitable correction in the setting of the relieving tool. As a definite example we will take a cutter with the following values:

R = 1.800 in.
h = 0.250 in.
N = 10 flutes
E = 0.250 in.

From the equation (17) we have

$$\tan \alpha' = \frac{10 \times 0.250}{3.600 \times 3.1416} = 0.22105$$

α' = 12 deg. 28 min.
$\cos \alpha'$ = 0.97642

From equation (18) we have

$$\sin \varepsilon = \frac{0.250}{1.800} = 0.13889$$

ε = 7 deg. 59 min.
$\tan \varepsilon$ = 0.14024

From equation (19) we have

$\cos (\alpha' + \varepsilon') = 0.97642 \, (1 - 0.22105 \times 0.14024)$
$= 0.94615$
$(\alpha' + \varepsilon')$ = 18 deg. 53 min. whence
ε' = 6 deg. 25 min. $\sin \varepsilon' = 0.11176$

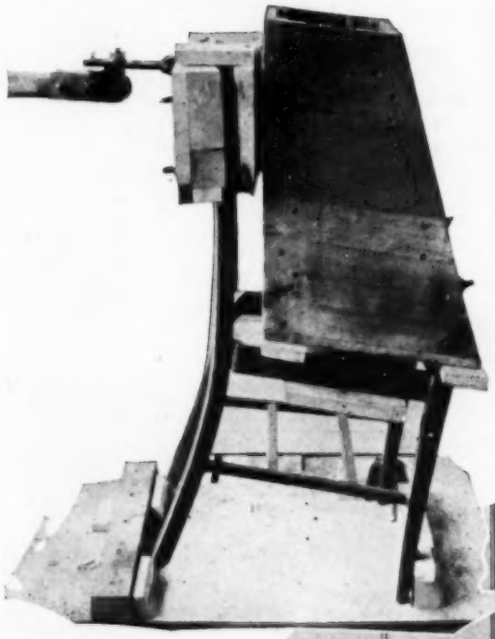
From equation (20) we have

$$s = 1.800 \times 0.11176 = 0.2012$$

Thus if the tool shown in Fig. 5, for example, is set 0.2012 in. above center, it will produce the form required on such a helical-fluted cutter with hook teeth offset 0.250 inches.

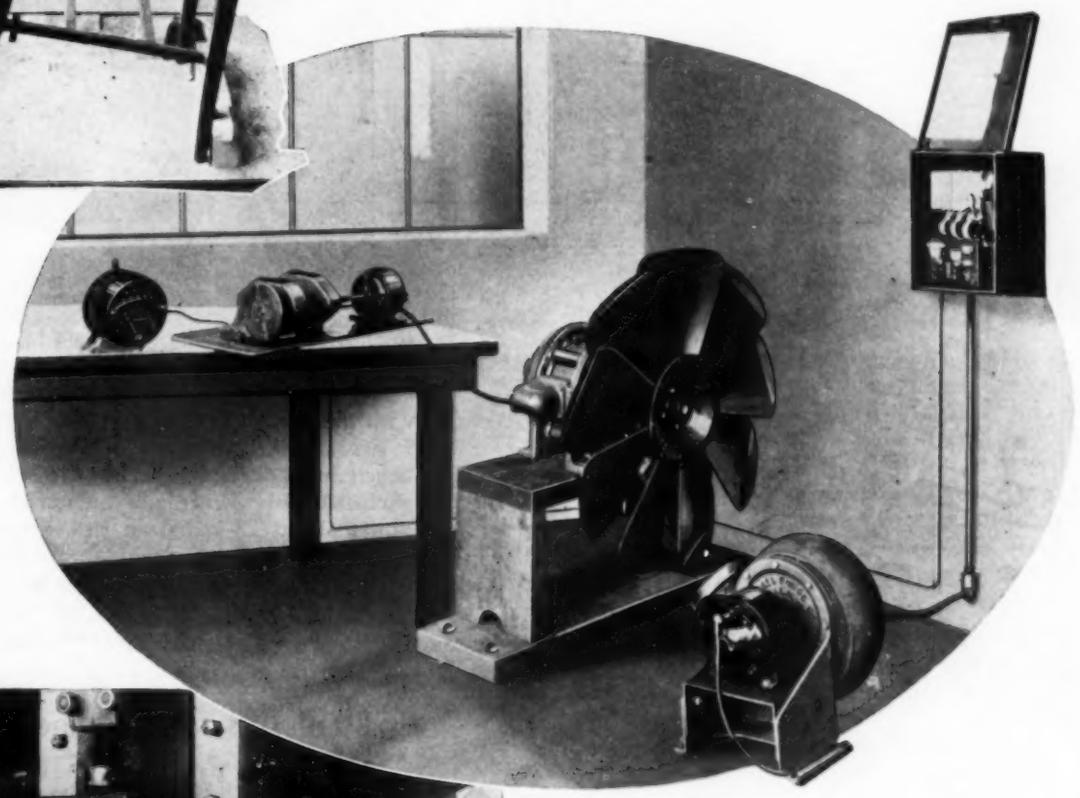
The common practice is to "back generate" these distorted forms, a method often requiring three or more intermediate tools to obtain the results, which are not always as accurate as desired. As shown above, however, it is purely a geometric problem, and once it is stated in such form the solution is almost self-evident, and the relationships established are readily compensated for in practice.

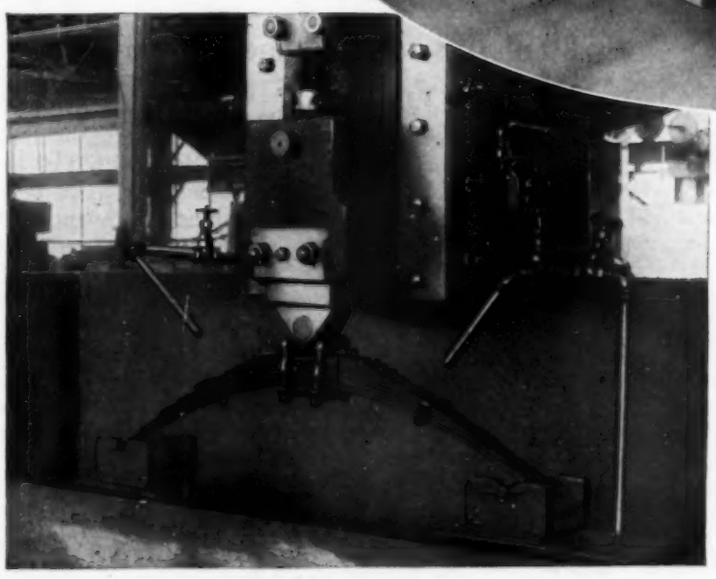
Testing the Product for Endurance



Testing aluminum chairs for endurance at the Buffalo plant of the Aluminum Company of America is done by placing on a load equal to the weight of a heavy man, and bumping the chair mechanically to simulate the hardest knocks that the chair would receive in service. Wooden chairs under this test lasted from 1 to 8 hours. The welded aluminum chair shown endured 186,240 bumps in 62 hours before developing a slight crack in the frame.

The Buffalo Forge Company desired to test its Breezo propeller fan wheels to determine the number of starts and stops the wheel would stand. An extra-large 3-phase induction motor was connected to the fan so that it would start quickly, and a switch was arranged to close the circuit in 10 sec., then open and allow the fan to stop. A "Baby Conoidal" fan was placed in front to blow against the blades and cut down the coasting period. A special timing device was used so that the Breezo fan would start up the instant that the other fan caused it to stop. It could start, attain full speed of 860 r.p.m., and stop within 40 sec. In testing the 30-in. Breezo wheel the test was continued for 516 hours, making 46,440 start and stops, or the equivalent of 50 years of service.





Vibration endurance tests for springs at the Ford Green Island (Troy, N. Y.) plant are made on a press which is set up to operate continuously, the spring under test being held in a special fixture to simulate actual working conditions. A counter on the ram designates the number of strokes taken before failure occurs. The compressing load applied by the press is a heavy overload as compared with the most severe load that the spring will receive in service, and the test spring must stand up to a designated number of vibrations, 100,000 to 190,000, depending on the type of spring, or the lot is rejected.

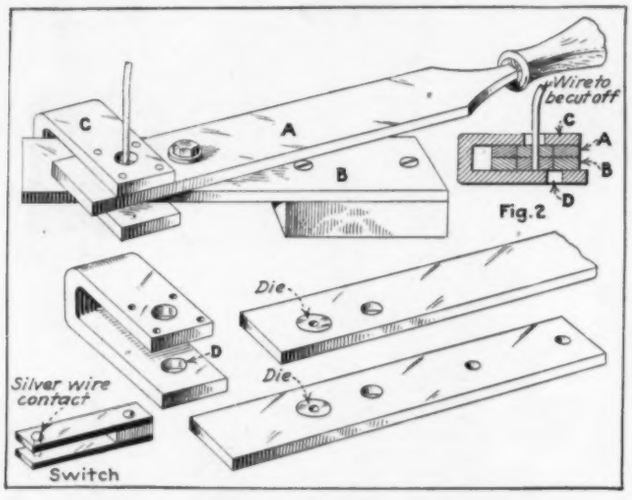
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Shearing Wire Accurately

By Charles H. Willey,
Asst. Plant Supt., Hoyt Electrical Works

We required for contact points in the leaves of spring switches for some of our instrument, short pieces of silver wire. As the wire was costly we desired to cut only a few hundred pieces at a time, and these had to be accurate. The diameter of the wire was .093-in. A vise shear, as shown in the sketch, was devised to do the



A cut-off fixture for wire

work. Two round dies were placed in the bars *A* and *B*, the lower bar being of the correct thickness to cut pieces $\frac{5}{64}$-in. long, at the part where the gaging clamp *C* works.

The action of the device is as follows: The shear is opened and the wire fed into the upper and lower holes of dies. Its end strikes the plate of the gaging clamp as in Fig. 2. The shear is closed and the wire cut off. The piece drops out of the hole *D*.

Shrinking Reinforcements on Brake Drums

By Charles F. Henry

The days have gone by when almost any sort of a sheet-metal stamping would answer for a brake drum. Today drums are carefully drawn of heavy-gage steel and bored or ground on the braking surface, which is now usually on the inside of the drum. Some are even made from forgings. In addition, the question of heat dissipation also receives careful consideration.

The Stutz car has a reinforcing band on the outside

Heater for shrinking reinforcing band in place

of the drum as shown herewith. This band helps to dissipate the heat of long continued braking, and also tends to prevent distortion of the drum from either pressure or heat. The band is a strip of channel section, rolled with the flanges out, and welded to the proper diameter.

For shrinking the reinforcing band in place a heating bench has been made as shown. The bench, which is surfaced with a refractory material, contains a heating unit that has 23 radial nozzles directing the heat of the gas flame against the inside of the ring and heating it so as to expand it uniformly. When heated, the ring is placed over the drum at the left and shrinks into place on cooling. The separate ring and drum are seen at the rear.

Drill Jigs for Crossheads and Shoes

By Frank C. Hudson

Supplementing the information concerning the drilling of bolt holes in crossheads on page 245, Vol. 70 of the *American Machinist*, the illustrations show more completely the use of some of the drilling jigs mentioned. The simple construction of the jigs for the crosshead itself is seen in Fig. 1, where both bushing plates are removed from the crosshead. These plates are shown in reverse from the way they are used, the narrow edges resting on the drilling table when in use and supporting the crosshead with sufficient clearance for the drill to break through. As illustrated, they show just how the drill bushings in the ledge *A* guide the drill through the lower flanges.

The crosshead shoes are drilled in a separate jig, both sides being shown in Figs. 2 and 3. The jig is simply a cast-iron channel of proper width to receive the shoe where it fits the crosshead. The shoe and jig are held

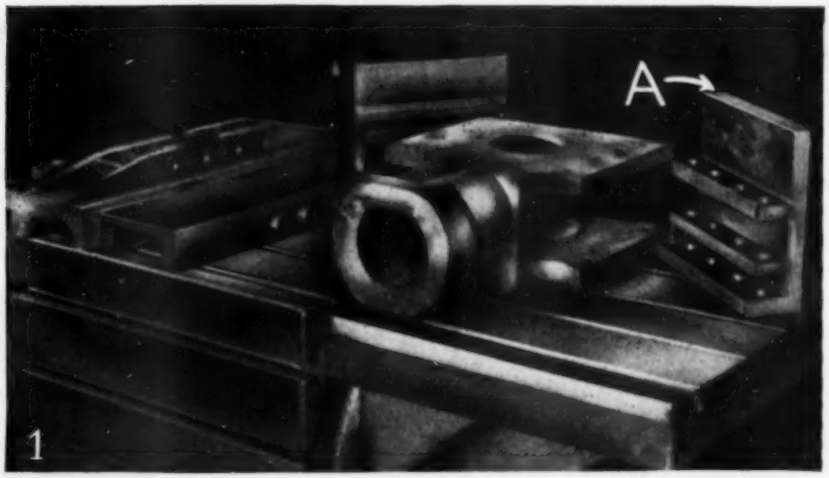
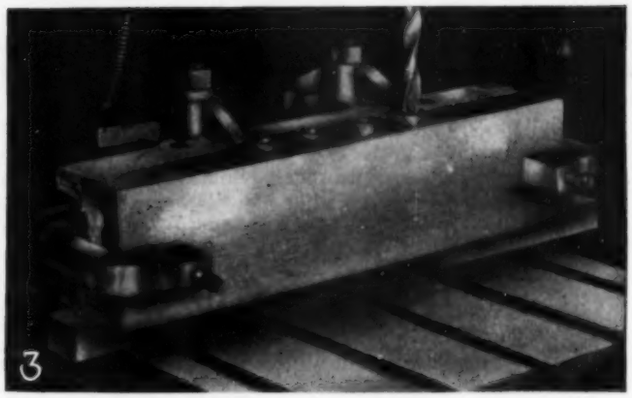


Fig. 1 — Drill jigs for crossheads and shoes, shown in the reverse position from which they are used

Fig. 2 — Crosshead shoe being drilled in a channel-shaped cast-iron jig

Fig. 3—Back of the shoe jig, showing the C-clamps used to hold it in place



together by plain C-clamps, being held to the radial drilling machine table by the conventional clamps shown.

Although simple, these jigs permit the crossheads and shoes to be drilled separately and kept in stock instead of necessitating their being drilled together.

Tool Service in a French Plant

By Serge Heranger

General Manager, Hotchkiss Gun Factory
Levallois-Perret, (Seine), France

OUR experience is probably the same as that of other manufacturers in that we have found our tool service to be a good indication of the entire production of the works. The output of the machines depends upon the tools and if the toolroom is badly organized the production capacity of the whole plant is reduced.

When we first realized the importance of proper tool control, we found that in our shop, as in most other machine-shops, our operators used their tools with little or no help from the management. For instance, we found lathes turning semi-hard steel bars and no two of the tools were alike. One lathe-hand preferred curved-faced tools, another flat-faced tools, one gave his tool a certain cutting angle—as to which, by the way, he was by no means certain—while another adopted an entirely different angle. As a result we found a great variety of tool shapes and tool profiles resulting from the different ideas of the workmen, which ideas were not based on any accurate data.

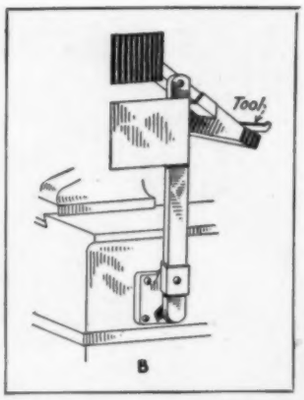
We also found that there was a great deal of machine time lost when the operators were resharpening their tools on one of the wheels, or grindstones, which were placed here and there throughout the shop. Machines were also idle when operators went to the central tool room for new tools or to exchange old ones. We found that the time lost in this way had considerably reduced our output.

Although this was many years ago, we knew that the tests of Frederick W. Taylor and other experimentors showed that in order to obtain maximum cutting efficiency it was necessary to use certain predetermined tool forms according to the nature and hardness of the metal to be cut, and that the best tool for every cutting job could be decided in advance.

We therefore developed a machine which would grind tools automatically at any desired angle, and we worked out a system of classification for all the tools in our plant. A letter indicating the class was stamped on every tool, and a set of instructions was given to the operator of this tool-grinding machine, which showed him exactly how to grind each tool according to its classification. The production orders given to machine operators in every case specified what tools were to be used on every cutting operation.

The next step was to avoid the waste of machine time, when operators went to the central toolroom to get fresh tools. A box was attached to the machine in which the operator could place the tools for the particular operation to be done; these tools were furnished in duplicate. We then built a signalling device, which we later attached to each machine. This consists of a balanced arm provided at one end with a trough to receive dull or damaged tools, and at the other with a disk painted red. A shield is attached to the upright in order to hide the red disk when the tool receptacle is empty. When the tool becomes dull the operator takes it off his machine and

places it in the receptacle. Its weight brings up the red disk, which can be seen half the length of the shop. The operator takes the duplicate tool from his box, places it in position and goes ahead with his work. We have a boy who makes regular trips through the shop at 10 min. intervals, collects these dull tools and takes them to a central toolroom, where we have two equal groups of pigeon holes marked according to the classification. One set is painted red and the other white. The boy who brings these tools from the shop notes the symbols stamped on them, sorts the tools into the red pigeon holes, takes the sharpened tools marked with the same classification from the white pigeon holes and carries them back to the operator.



Signalling device to indicate when tools need regrinding

The man who grinds the tools takes them from the red pigeon holes, one at a time, sharpens them, and replaces them in the white pigeon holes. This man does not need to be a toolmaker, but merely a careful machine operator, because the machine is semi-automatic and the table of instructions gives him all the information he needs.

Obviously these methods were not developed in one day, but were built up slowly and simplified in practice. They have been in operation for several years and have the following advantages:

1. We have less spoiled work because tools with the proper cutting angle are selected for each operation by our experts in our engineering department and not by machine operators.
2. The operation of time is reduced because the tool which will take off the most metal is selected according to scientific formulas.
3. Production is increased because machines are not idle, while operators are sharpening tools or seeking fresh ones at the tool distributing center.

Preventing the Breakage of Small Taps—*Discussion*

By Wm. S. Rowell

In an article on page 562, Vol. 70, of the *American Machinist,* Charles Doescher tells why so many small taps are broken and gives several preventive measures, for which he deserves the thanks of all users of taps. However, I would like to add the following:

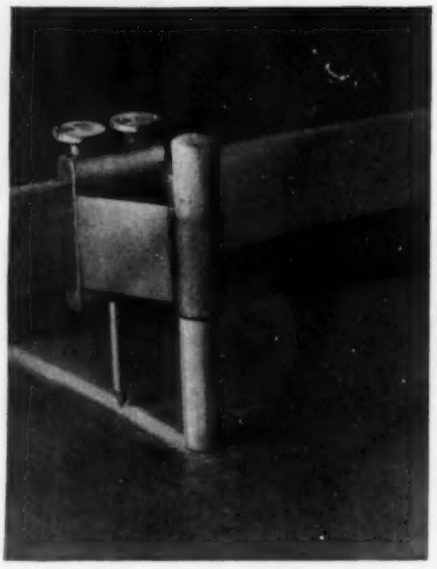
When tapping full threads it is advisable to use two taps, on the first of which the outside diameter should be reduced by grinding until the threads have been ground away to about the pitch diameter. It might be thought that this procedure would be difficult and expensive, but it is not.

Take, for instance, a ½-in. U. S. S. tap. The full depth of the thread is 0.0499 in. Simply grind 0.025 in. off of the tops of the lands, using a micrometer as a guide, and the job is done. With such a tap, followed by one of full diameter, the toughest metal can easily be tapped without danger of breaking the tap.

Chalking and Scribing a Line Simultaneously

By Arthur Kendall
Hamilton, Ont., Canada

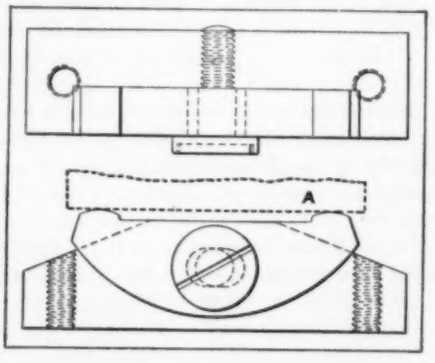
Having to lay off a number of large-sized half circles from time to time, I found it awkward to have to chalk the preparatory lines that form the backgrounds for the scribed lines proper. To facilitate the work, I made a marking tool of my own, similar to a pair of trammels, but with the following exception: A chalk holder in the shape of a spring clip was fitted and soldered to the body of the scriber holder. The clip is open at the ends and is set about an inch ahead of the scriber point. The operation of the tool is obvious from the illustration. To secure the best results, I press down lightly with a forefinger on top of the spring clip between the chalk and the scriber while revolving the tool.


Tool for chalking and scribing

An Equalizing Block for a Milling Fixture

By H. J. Gustav Kopsch

A milling fixture was built for holding a long lever while the boss *A* was being milled. The support for the boss was rigid and did not accommodate itself to the work, which was more or less warped. The result was that much time was wasted in packing and wedging up the work. To overcome this trouble, the equalizing block shown in the illustration was made. The "rocker" fits in a circular seat in the base and is confined therein by a shoulder screw engaging in a slot long enough to allow the rocker a limited amount of rotative motion. As clamping pressure is being brought upon the work, the rocker automatically adjusts itself to any irregularities. When the work is fully clamped, the friction between the rocker and its seat is great enough to prevent any movement.



Equalizing block for a milling fixture

Business Ethics

National Machine Tool Builders' Association

PRINCIPLES

I. The foundation of business is confidence; which springs from integrity, fair dealing, efficient service, and mutual benefit.

II. The reward of business for service rendered is a fair profit plus a safe reserve, commensurate with risks involved and foresight exercised.

III. Equitable consideration is due in business alike to capital, management, employees, and the public.

IV. Knowledge—thorough and specific—and unceasing study of the facts and forces affecting a business enterprise are essential to a lasting individual success and to efficient service to the public.

V. Permanency and continuity of service are basic aims of business, that knowledge gained may be fully utilized, confidence established, and efficiency increased.

VI. Obligations to itself and society prompt business unceasingly to strive toward continuity of operation, bettering conditions of employment, and increasing the efficiency and opportunities of individual employees.

VII. Contracts and undertakings, written or oral, are to be performed in letter and in spirit. Changed conditions do not justify their cancellation without mutual consent.

VIII. Representation of goods and services should be truthfully made and scrupulously fulfilled.

IX. Waste in any form—of capital, labor, services, materials or natural resources—is intolerable, and constant effort should be made toward its elimination.

X. Excess of every nature—inflation of credit, over-expansion, over-buying, over-stimulation of sales—which create artificial conditions and produce crises and depressions, are condemned.

XI. Unfair competition embracing all acts characterized by bad faith, deception, fraud or oppression, including commercial bribery, is wasteful, despicable and a public wrong. Business will rely for its success on the excellence of its own service.

XII. Controversies will, where possible, be adjusted by voluntary agreement or impartial arbitration.

XIII. Corporate forms do not absolve from or alter the moral obligations of individuals. Responsibilities will be as courageously discharged by those acting in representative capacities as when acting for themselves.

XIV. Lawful co-operation among business men and in useful business organizations in support of these principles of business is commended.

XV. Business should render restrictive legislation unnecessary through so conducting itself as to deserve and inspire public confidence.

ABSTRACT OF PRACTICES DESTRUCTIVE TO THESE PRINCIPLES

PRINCIPLE I—Permitting agents, distributors or employees to conduct transactions on a lower plane of business practice than set out in this code; discrediting the equipment, product, methods or personnel of a competitor; quoting fictitiously high prices at the outset of a transaction, and lowering them without proportional changes in quantity or specifications; and taking advantage of a customer's ignorance to sell him something that is not best suited to his needs.

PRINCIPLE II—Booking orders so far in advance of production that changes in costs cannot reasonably be anticipated; neglecting the utility factor of value in making prices of high-production tools; and neglecting the cost of necessary idleness and the risk of obsolescence of design and equipment.

PRINCIPLE III—Not paying wages and salaries commensurate with the ability required in workmen, and in supervisory, technological, selling and administrative staffs. Making prices that do not adequately cover implicit costs as well as out-of-pocket expenses, and thereby depriving stockholders of a fair return.

PRINCIPLE IV—Failure to join in mutual education as to the facts and forces affecting the industry as a whole; failure to install an adequate cost and accounting system; quoting prices on incomplete data, or on none at all; giving estimates or guarantees of performance on inadequate data.

PRINCIPLE V—Neglect of necessary improvements in design and manufacture; and failure to study economic conditions inherent in the industry, and to base business policies on sound economic principles.

PRINCIPLE VI—Failure to study conditions and collectively to inform the industry's customers of these conditions has contributed to irregularity in employment: Therefore, it devolves on every machine tool builder to further the education of customers in forecasting their own needs of machine tools, and to induce them to place orders with due regard to economic conditions.

PRINCIPLE VII—Failure to adopt or conform to recognized trade terminology in listing or describing machine tools, and thus creating confusion and misunderstanding; quoting time of delivery without proper consideration of all reasonable conditions or without adequate production planning; and accepting cancellations of orders taken in good faith, and in process of legal performance.

PRINCIPLE VIII—Selling repaired or rebuilt machines as new, or selling new machines as repaired or rebuilt. Overstatements or misrepresentations concerning any machine or of any part thereof.

PRINCIPLE IX—Taking in used machinery at prices too high to give a fair profit realization as part payment for new machines; encouraging speculative stocking by dealers; speculative stocking by builders, leading to great losses through obsolescence; guaranteeing buyers against declines in price; creating unnecessary sizes and styles; and failing to join in reasonable standardization of tool- and work-holding elements.

PRINCIPLE X—Refusal to join in the collection and dissemination of facts, which knowledge alone can prevent such excesses from getting under way; and granting credits for excessively long terms.

PRINCIPLE XI—Granting individual demands for free service, discriminating terms, discriminating prices, extra attachments, or any other thing or service that is not openly offered to all buyers who may be in the market at a given time; copying or using designs of others; threatening suits for patent infringement without good faith, for purposes of intimidation; tampering with and misadjusting a competitor's machine to discredit it with a purchaser; selling goods at or below cost to embarrass a competitor; combining to enhance or maintain prices, or to bring about substantial uniformity in prices, or to divide territory or business, or to put a competitor out of business; and quoting prices on combinations in which competitive machines are underpriced, and non-competitive machines are correspondingly over-priced.

PRINCIPLE XII—Causing unnecessary litigation, or refusing to discuss disputed matters, or to submit to impartial arbitration where possible.

PRINCIPLE XIII—Claiming that unethical actions are due to pressure from boards of directors, or creditors, and seeking to justify them on that account.

PRINCIPLE XIV—Failure to maintain a friendly attitude toward competitors, and accepting without verification reports that reflect on their honesty of intent, purpose or act; failure to assist in improving conditions in the industry by contributing information respecting economic facts that would assist all the industry to arrive at sound conclusions.

PRINCIPLE XV—Failure to build machines conforming to standard safety codes; and conducting any association activity in such a manner as to violate the laws of the nation.

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Wire Gages Again

IF EVIDENCE were needed as to the foolishness and futility of numbered wire gages the confusion existing in the music wire field should be convincing. With several gages listed in standard handbooks and with wide variations in these gages, there is, of necessity, more or less confusion in different quarters.

Indications point to the music wire gage of the American Steel Wire Company as being the one most in use. The Bureau of Standards has, in fact, recommended the adoption of this gage as the standard, the company agreeing to drop the trade name in order to avoid any appearance of favoritism. The gage is now supposed to be known simply as the Music Wire Gage.

How much easier it would be to abandon all gages and designate the desired size in thousandths of an inch or mils. If it is more convenient to use numbers why not call for a 270 wire instead of a number 10? Then everyone would know exactly what was meant without consulting a table.

Securing Accuracy with Economy

MANUFACTURING tolerances should vary according to the function of the part or unit being made. What may be a fair dimensional limit for one piece may be either too great or too small for another, which indicates to what an extent individual judgment enters into the problem of determining the precision needed on any particular job. As costs may be considered to vary proportionately with the accuracy required, with the same equipment and methods, it is evident that the production man should be consulted before the tolerances are finally determined. Should very close tolerances be considered necessary, production costs can frequently be kept down by installing more modern equipment.

Where tolerances are set without consulting the production men, difficulties of several sorts are experienced. Costs go up, due both to unnecessary accuracy in certain parts and to an undue amount of scrap. For, while strict interchangeability requires very close tolerances if working clearances are maintained with extreme accuracy, there are many places where selective assembly is more economical and just as satisfactory to all concerned. Here, too, the production men can be of great service in keeping down costs.

Knowing that very close tolerances can be maintained, the designer or draftsman who is not familiar with production costs is apt to specify them where they are not necessary. Machine manufacturers' advertisements frequently stress the accuracy of their machines, and one who does not know the details of production or its cost seems justified in calling for close tolerances at any time.

From every point of view it must be apparent that best results will be obtained by a conference between the design or engineering department and the production department before tolerances are finally set. There should be no opposition by production men to extreme accuracy where it is required although it may be a question as to whether it should be secured by close tolerances or by selective assembly. Neither should the engineering department insist on "tenths" where thousandths are close enough. Harmony and cooperation between engineering and production departments mean the saving of money that might otherwise be wasted.

Tariff Facts

AS A GENERATOR of waste heat the tariff is quite as effective as any other brake, mechanical or political. Much of this heat is dissipated through the medium of legislative oratory but enough remains to be potentially dangerous.

If all of those interested in tariff legislation, selfishly or otherwise, would make sure of their facts before expressing opinions of their own, or accepting the opinions of those who advocate too high or too low a tariff, much of the wasted heat could be converted into useful work.

It is obvious that some domestic products are receiving too little protection, and that others are receiving too much. And it is equally plain that some of the statements made against the American protective tariff policy are based more on emotion than on statistics. It is often convenient to forget the amounts spent abroad by American tourists, and to ignore the fact that American imports generally are increasing in spite of the tariff.

Facts, and facts alone, can straighten out the muddled thinking on subjects such as the tariff, where emotions are too likely to swing opinions, and votes.

"Fastermatic" Nos. 1-, 2-, 3-, and 4-F Automatic Chucking Machines

FOUR automatic chucking units known as Nos. 1-, 2-, 3-, and 4-F, have been placed on the market by the Foster Machine Company, Elkhart, Ind. The machine is built in the platen and automatic indexing turret types, each of which is now being manufactured in four sizes, with respective swings over the bed of 17, 22, 25½ and 33 inches.

A feature is that the feeding mechanism controlling movements of the tool carrying units is gearless. All feeds are actuated from a hydraulic ram into which oil is forced from an Oilgear control pump located on the head end of the machine and driven through a silent chain from the main drive shaft. During the period of feeding, a constant oil pressure is maintained on each side of the piston inclosed in the ram. It is obvious, therefore, that there exists a back pressure on the side of the piston opposite to that on which the feeding pressure is applied. This character of regulation is necessary to maintain a uniform feeding movement to the tooling when the cuts are intermittent or of irregular depth. The regulation here is fully controlled automatically through the Oilgear unit. Furthermore, the heavy construction prevents chatter and vibration.

The feeding movements to the tool carrying units range from 0 to approximately 40 in. per min. The feed changes are effected through varying the capacity of the pump and its delivery of oil to the ram. Cams, which may be easily and quickly adjusted, are qrovided for obtaining the desired feed and to maintain automatically the same after being adjusted.

The return of the tooling from the work at the completion of all machining operations is effected automatically through the rapid traverse action of the ram, and also, the tooling is returned to position for the beginning of the cuts by the rapid traverse action. At the completion of the cycle, the tooling is retained in the returned position until the feed is re-engaged by hand. Another feature pertaining to the feeding movement is that the rapid traverse movement can be started automatically during any portion of the feeding movement thus reducing the time on work having wide spaces between the turned or bored lengths. The feature described are characteristic of both the platen and indexing turret type machine.

With the platen type Fastermatic, the tool carrying units consists of a front and rear cross slide and a main slide, all of which are mounted on a platen. The platen, through the action of a ram, carries the tooling to the correct position for the beginning of the machining operations, and away from the work after the tooling units have receded. The movements to the platen ordinarily are rapid, but are fully controlled, and when desirable, can be reduced automatically reduced to any rate of travel which may be required for feeding auxiliary tooling bolted to the platen.

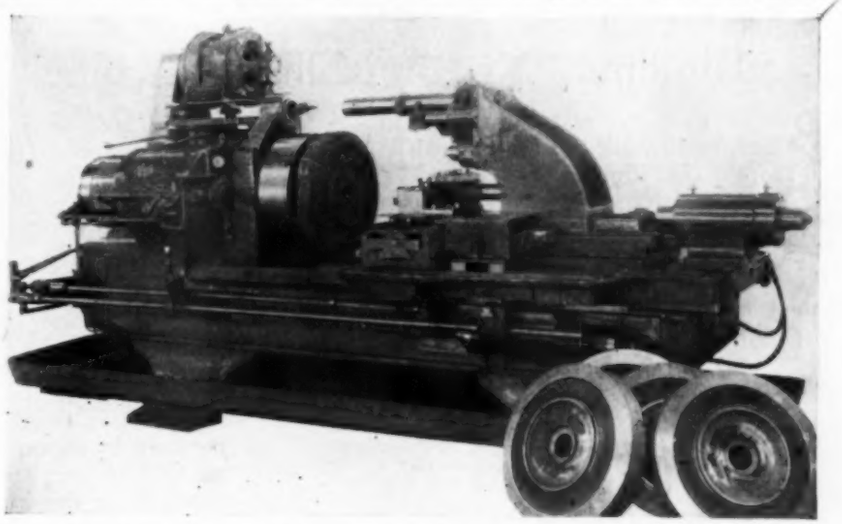


Fig. 2—"Fastermatic" Platen-Type Automatic Chucking Machine of the No. 4-F size for heavy work

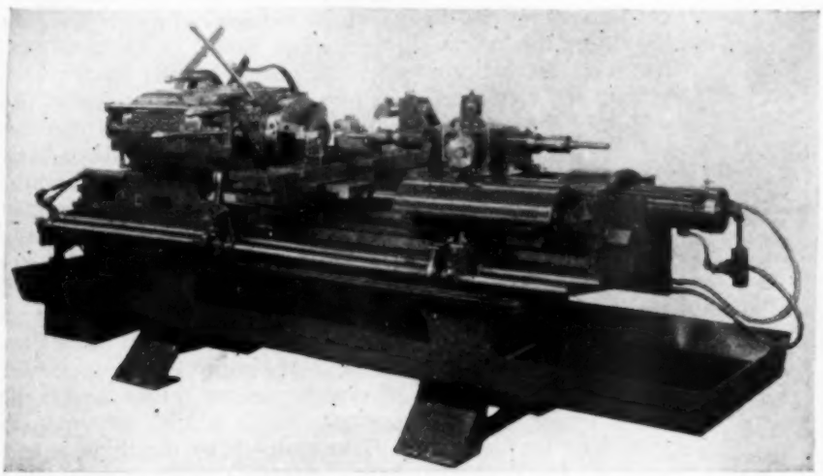


Fig. 1—"Fastermatic" No. 2-F Automatic Indexing Turret-Type Chucking Machine

With the indexing turret type "Fastermatic", the tool carrying units consist of front and rear cross-slide mounted on a bridge spanning the bed, and an automatically indexed hexagon turret. The cross-slides are adjustable longitudinally.

The hexagon turret advances and returns automatically, and the entire action is effected from an oil ram located central between the ways at

the rear. A rapid traverse places the turret in position for starting the boring and turning operations. From this position, the turret continues to feed at a predetermined rate. The longitudinal movements of the turret faces are controlled by cam action The cams are carried on a spool and index automatically in correct relation to the faces of the turret. Each cam is adjustable and a separate and independent feed for each face of the turret is readily available. The turret can be adjusted to remain at any position of the turret after the return, or the full travel back and forward may be accomplished without indexing.

The cross-slides can be operated simultaneously or independently, and they can be timed to operate in conjunction with any one of the turret faces. Their movement is effected through the action of cams beneath the slides and controlled by the movement of the turret. At the completion of the cycle, the entire tooling is moved clear of the work until the feed is re-engaged by hand. Provision is made for the use of overhead piloted tooling as well as that central piloted. Chucks such as used on ordinary turret lathe are readily adaptable to these machines.

In the 1- and 2-F machines, eight spindle speeds are available, while in the 3- and 4-F machines twelve spindle speeds are provided. All Fastermatics are built with Timken-equipped spindles, ball bearing back shafts, multiple-disk clutches, and an all-steel gear train operating in oil.

"Rigidmil" No. 30 Milling Machine

BOTH hydraulic and mechanical feed mechanisms can be obtained on the No. 30 "Rigidmil" announced by the Sundstrand Machine Tool Company, Rockford, Ill. The hydraulic feed permits any desired rate between 0 and 50 in. per min. and embodies a rapid traverse at 103 in. per min. The mechanical feed supplies a gearbox for pick-off gears and a longer drive shaft than is used with the hydraulic unit. Three pairs of pick-off gears for six feeds from 1.49 in. to 22 in. per min. are supplied as standard. The machines have a working surface of 14½x50 in., standard, and 14½x70 in., special. The standard table feeds are 20 in. for the hydraulic and 32 in. for the mechanical, and 30 in. for special hydraulic and 50 in. for the special mechanical mechanisms.

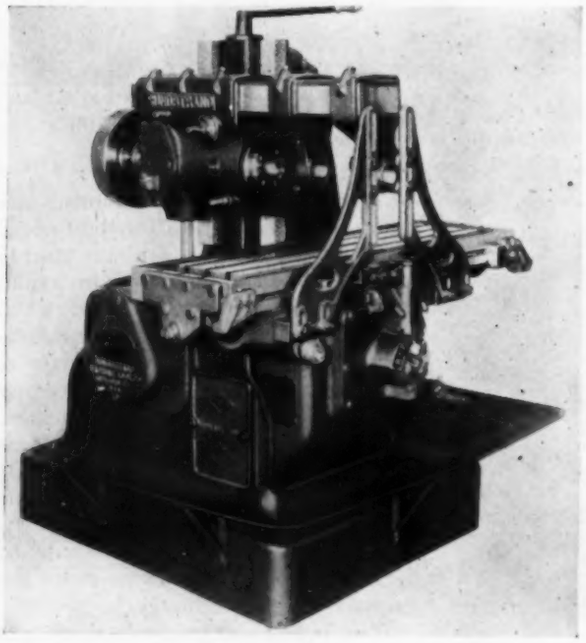


Fig. 1—"Rigidmil" No. 30 Milling Machine, which may be obtained in the hydraulic or mechanical feed type

Hydraulic feed is obtained by means of an Oilgear pump mounted in the base. The feed rate best suited to the work in process can be obtained instantly. If abnormal conditions overload the cutter, the hydraulic feed automatically retards and then accelerates to the set rate, when normal conditions return. The hydraulic feed mechanism is simple, durable, self-lubricating. The manual control is through a lever, shown in Fig. 2, on the front of the panel and may be set in five positions, rapid traverse to the left, feed to the left, neutral, feed to the right, and rapid traverse to the right.

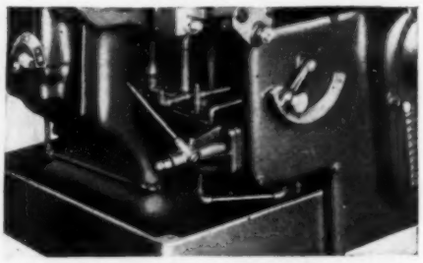


Fig. 2—The control lever for the direction of the feed and rapid traverse is at the left. The lever controlling the rate of feed is at the right

Automatic table control is governed by two stop blocks with nine dogs located between them, all adjustable. The blocks will cause the table feed to throw out within plus or minus 0.002 in. of a selected point. The dogs may be used in various combinations to obtain any desired cycle of feeds and rapid traverses. For example the work may be rapid traversed to cutters, feed engaged, and table returned to starting position on completion of cut, all automatically. Dogs may also be set for rapid traverse, feed, and repeat, as desired.

The base-column-saddle casting is made in one piece and is compact and rigid. The spindle head is a compact unit mounted on the column with narrow guides for alignment. It carries a forged steel spindle suspended in Timken roller bearings front and rear and having a National Standard nose with hole 2¾ in. in diam. at large end and 3½ in. taper per ft. The entire spindle assembly is carried in a steel quill hardened and ground and having a 4 in. traverse adjustment. Smooth spindle drive is obtained through a coarse pitch spiral bevel pinion and gear. Pick-off gears, located in the main casting just below the column, provide changes of speed and direction of rotation for the spindle. A flywheel aids in preventing vibration and chatter from heavy or irregular cuts and tends to lengthen the cutter service. The overarm is a solid steel forging, rectangular in shape, and adjusted by means of rack and pinion. The construction of this unit lends itself readily to the application of special cutter heads and other devices.

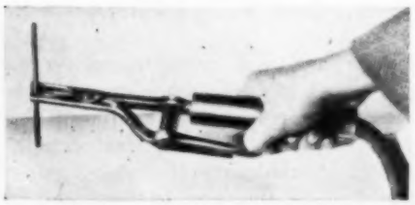
The main drive clutch is a compact, powerful, sensitive unit of the multiple-disk type. It runs in an oil bath and is adjusted easily. Drive is

obtained by motor only, a 5-hp. 1,200 r.p.m. type being standard. It is mounted inside of the base on an adjustable plate and drives the primary shaft through a silent chain fully-inclosed. Coolant is drawn from a large reservoir in the main casting and pumped to the cutter at the rate of 6 gal. per min. It is strained before going to the cutters a second time. A vertical spindle head and rotary table for the No. 30 are available in place of the standard head.

Specifications: Vertical adjustment of spindle, 10¾ in. for both sizes; horizontal adjustment of spindle, 3 in.; distance center of spindle to underside of overarm, 6½ in.; maximum distance center of spindle to table, 13⅜ in.; minimum, 2⅝ in.; maximum distance spindle face to outer edge of table, 14⅜ in.; minimum, 11⅛ in.; spindle speeds, 30 to 278 r.p.m.; table feeds, hydraulic machine, 0 to 50 in., mechanical machine 1.49 to 22 in.; rapid traverse, 103 and 77 in. per min., respectively; table height 35 in.; total weight, 5,100 pounds.

Westinghouse Metal-Electrode Holder

A light metal electrode holder has been announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to take all commercial sizes of arc welding electrodes up to and including ¼ in. in diameter. The jaws are made of pressed-metal



Westinghouse Metal-Electrode Holder

and will grip the electrode in any position or at any angle. The close distance between the lower jaw and the upper handle allows the device to be used in close quarters. The holder is furnished with or without 5 feet of flexible cable. The holder weighs approximately 18 ounces without the cable.

For light carbon electrode welding or cutting, an adapter which handles ⅜- and ½-inch carbon rods can be furnished.

Moline Model R-600 Radiator-Section Boring, Facing, and Tapping Machine

STEAM connections of ordinary residence-type radiators may be bored, faced, and tapped on the automatic machine built by the Moline Tool Company, Moline, Ill. This machine is made with four spindles and can be arranged to have all spindles boring and facing, or all facing and tapping, or half boring and half tapping. In Fig. 1 is shown the front view of one of these machines, with the work in position, ready for the boring and facing operation. A rear view, Fig. 2, illustrates the Oilgear feed equipment.

The general construction of the machine consists of a large bed with V-guides for the two rails that carry the spindle units. These rails are gibbed and are actuated by hydraulic cylinders, one for each rail, and in order to have the same amount of pressure on all tools, the slides are connected through a rack and pinion, equalizing their traverse so that if one cylinder does not function properly, the other cylinder will operate both rails to its capacity. All fast running shafts and spindles are ball bearing mounted and the spindles are provided with end adjustment for setting tools in relation to one another. The machine is equipped with three motors, one on each rail, driving two spindles, and the third motor is mounted at the bottom of machine to operate the Oilgear feed pump. The main drive in each case is through Texrope belts and spiral gears to the spindles.

In the center of machine there is a holding fixture, consisting of an adjustable bar carrying V-block guides and a stop insuring the proper setting of the work. The adjustments for various sizes of radiator sections are made by a gear and screw through the square shaft shown directly above the foot lever at the front of machine. Above this holding fixture are two V-clamps, which hold the sections securely in the fixture.

The cycle of operation is as follows: With spindles running, the operator inserts a casting into the fixture; he then steps on the foot pedal, releasing the clamps which are brought into position through weights, after which the spindles feed in to the proper depth, performing the boring operation and run up against positive stops for facing. When sufficient pressure is built up, the flow of oil is automatically reversed, bringing the tools back to the starting position. As

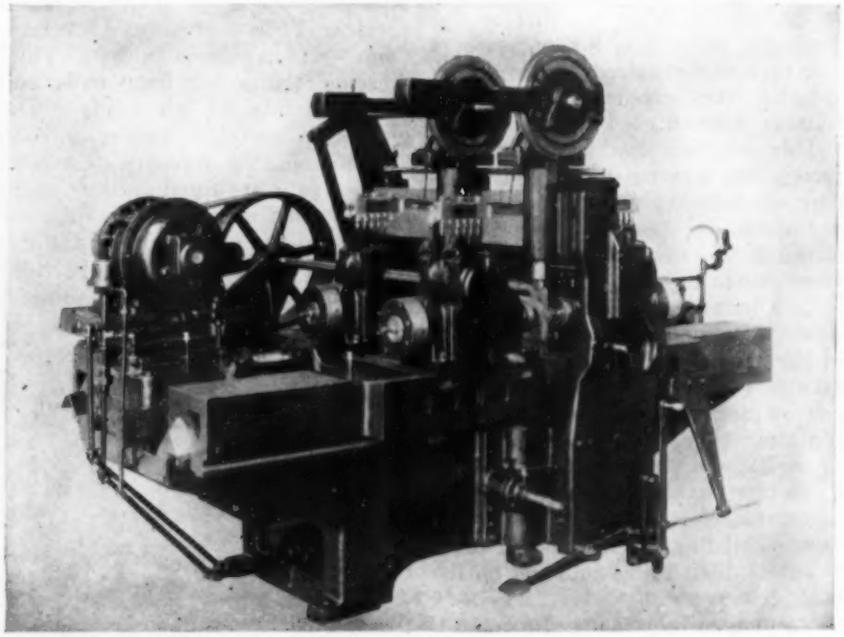


Fig. 1—Front view of the Moline Model R-600 Radiator-Section Boring Facing, and Tapping Machine

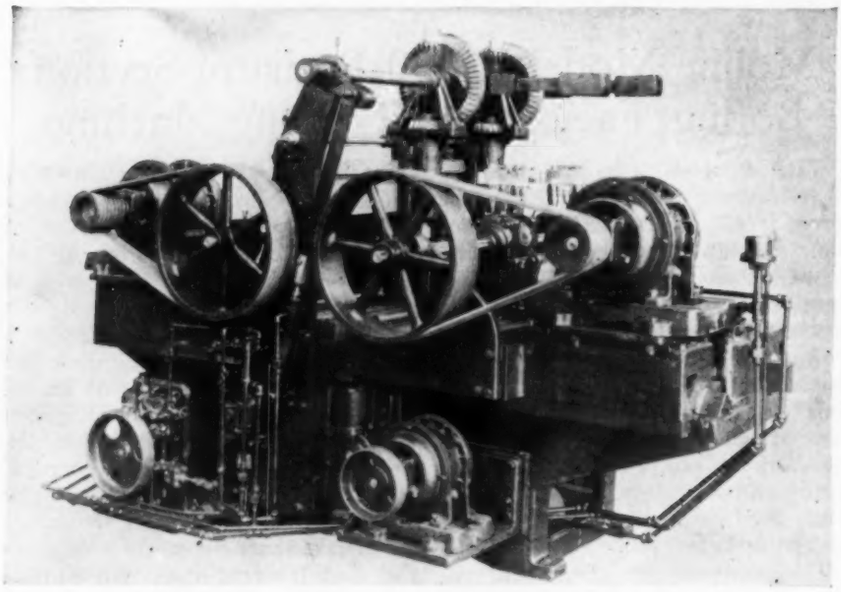


Fig. 2—Rear view showing the Oilgear feed and clamping units

soon as the tools clear the work, sufficient oil is released from the pressure circuit and flows to an auxiliary cylinder, as shown on rear view of machine, Fig. 2, raising the clamps to the release position, thus completing the cycle. As soon as the operator can remove the finished casting and insert another the operation is repeated.

Production obtainable with this machine is 225 sections per hour. The advantages of using the hydraulic feed over mechanical are increased production and increase in the safety factor. If the tools are dull or the work put in wrong, the pressure is built up to that required for reversing, bringing the spindles back to the starting position.

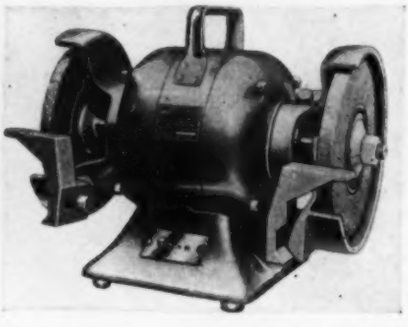
This machine can be adapted to facing and tapping, and rough castings are bored, tapped and faced in one operation, the cycle being almost identical to that described above. However, in this instance, the tapping is done by mechanical feed through a screw and nut having the same lead as the tap used for the work. The facing is done hydraulically and the cutters are mounted on the main spindles, while the taps are inserted in small spindles operating through the center of large spindles, and are adjustable endwise, the same as the facing spindles. One common drive motor is used, being mounted on the base, driving through open and closed belts, so as to keep the timing correct. Average production on this machine is 90 sections per hour. The machine can be adjusted to take any section from 5 to 13 in. wide and from 8 to 38 in. between centers of the connections.

The approximate weight of the boring and facing machine is 15,000 lb., and that of the facing and tapping machine, 18,000 pounds.

Van Dorn 6-Inch Bench Grinder

A 6-in. bench grinder has just been announced by the Van Dorn Electric Tool Company, Cleveland, Ohio. It has been built for tool dressing, sharpening hand tools, and light grinding of all kinds. The grinder is portable, weighs only 36 lb., and has a convenient handle. Rubber pads are fitted on the base to eliminate the necessity of bolting the grinder to the bench for light work. The shaft is mounted on ball bearings with dust-proof housings. The motor is also completely enclosed, and can be operated from the lighting circuit.

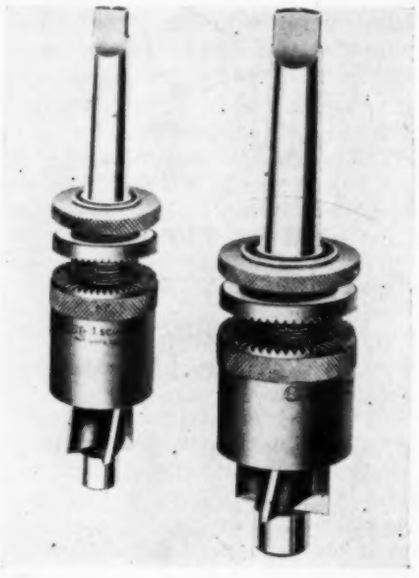
The grinder is equipped with two 6-in. grinding wheels, wheel guards and toolrests, and a 3-wire cable and plug.



Van Dorn 6-Inch Bench Grinder

Eclipse Quick-Adjustable-Collar Toolholder

An improved stop collar tool holder has been placed on the market by the Eclipse Interchangeable Counterbore Company, 7410 St. Aubin Ave., Detroit, Mich. The bushing on the collar can be adjusted by hand without the use of wrenches, hammers or punches. The device is recommended for use as a holder when counterboring, spotfacing, countersinking, or core drilling to a specified length. The adjustable collar stops against the top of the fixture bushing, or against the work being machined, and regulates the depth of the cut or travel.



Two sizes of the Eclipse Quick-Adjustable-Collar Toolholder

Quick hand adjustment of the collar up or down may be accomplished by backing off the upper locknut, lifting the drive washer, turning the stop collar to the desired position, and then lowering the drive collar and turning down the locknut. A slight pressure of the locknut on the drive washer, when engaged with the stop collar, locks all of these parts solidly in place on the holder.

The illustration shows the tool for

use in a drill press, which is the most common use. By changing to a straight shank, the holder may be used for tools in turret lathes. The holder can be furnished in all standard sizes suitable for use with Eclipse standard and special counter-bores, core drills, and other tools.

Heller "High Efficiency" Cold Metal Saws

SEVEN sizes of metal cutting-off machines having capacities ranging from 1¾ to 20 in. are offered by the Steinle Machine Company, Madison, Wis. These machines are of the "Heller" make. The constructional features include sturdy design, all-steel gearing, ball bearings, a long saw arbor carriage slide bearing, and final saw arbor drive through a worm gear unit. The blade cuts the stock on the upward motion, thus placing the stress of the cut directly on the spindle carriage rather than on the bearing cap. This construction prevents vibration and chatter.

Four blade speeds and five blade feeds are available through selective gearing, thus giving flexibility of operation for hard as well as soft materials. Control of the feeds is from the operator's position at the front and they can be changed while the blade is under cut. A clutch acts as a safeguard against excessive pressure and thus prevents any damage to the saw blade or machine should the carriage be run up against the work through carelessness. Adjustable feed trips are provided, and at the completion of the cut the blade carriage returns automatically to the starting position by power traverse.

The work is fed to the stock stop mechanically by a roller arrangement which is brought into contact with the bar by a slight pressure on the control lever. This moves the stock to position accurately and relieves strain on the operator. The free end of the bar is carried upon a roller bar carrier traveling upon a narrow gage track at right angles to the machine. Clamping of the stock is facilitated by means of the hammer-type clamping wheel, which does away with the necessity of a hard straight pull on the stock clamp to get it sufficiently tight for cutting. Drive is through a single pulley direct to a change gear box, and all gears run in oil and the shafts on ball bearings. A special chip remover removes chips from the blade after the teeth pass through the cut.

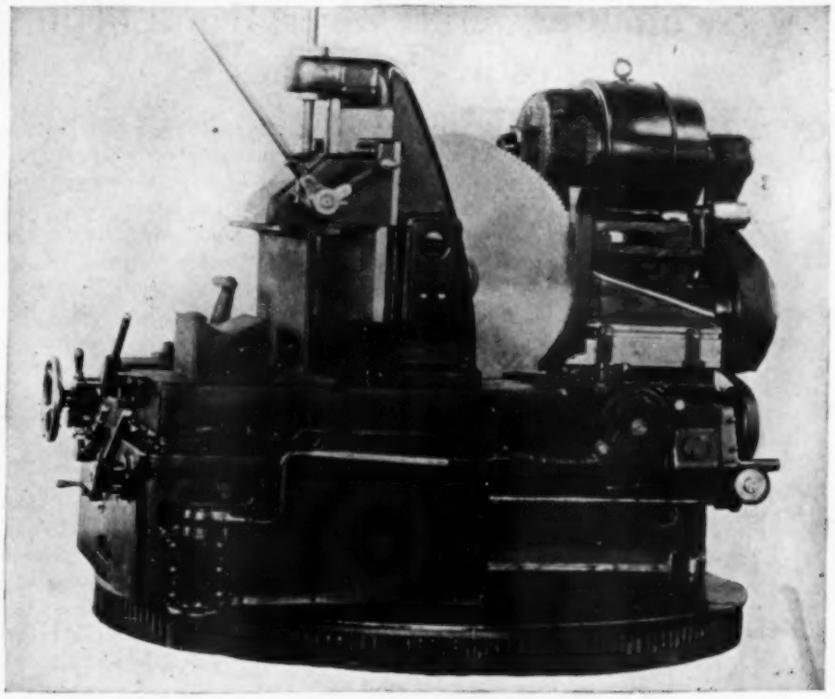


Fig. 2—Heller "High Efficiency" Saw arranged with a rotary base and cross feeding table for angle cutting

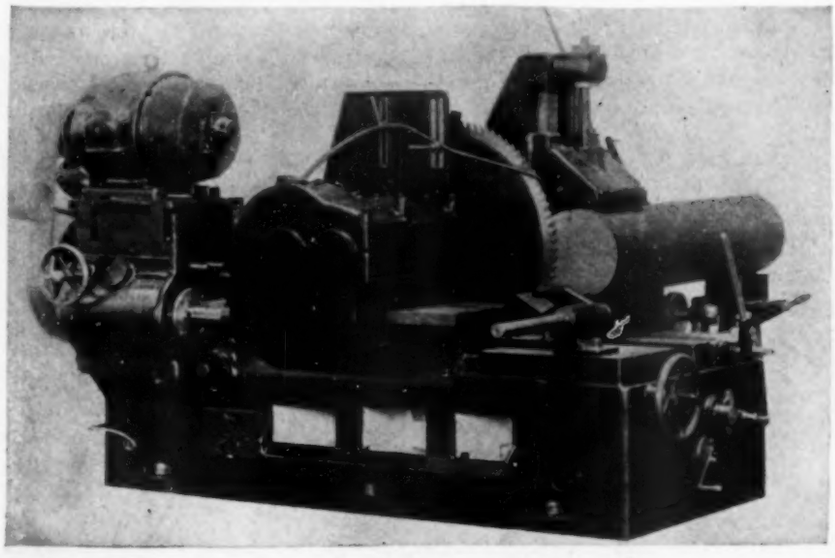


Fig. 1—Heller "High Efficiency" Cold Metal Saw

A deep sump for coolant compound is built integral with the machine base and furnishes a heavy flow through a separate pump to the blade. Where motor drive is desired the motor is placed upon the top of the gearbox and the drive is by a belt with an idler pulley arrangement to secure adjustment. The blades furnished with the machine are of the original "Heller" segmental type composed of a center disk of heat-treated high tensile steel having a set of high-speed steel segments riveted on the periphery. These segments are milled

or slotted to fit directly over the shouldered edge of the disk so as to insure proper alignment under severe cuts. Each segment comprises four cutting teeth the alternate teeth being of the beveled roughing type or square finishing type so that the chip is split into three parts to relieve the strain of the cut.

Specifications for the several models: Capacity, rounds, 1¾ to 18 in.; squares, 1⅜ to 16½ in.; I-beams, 3x2 to 30x14 in.; motor required, 2 to 25 hp.; and weight 800 to 19,000 lb. These machines are also built in special types with rotary base and cross feeding table for angle cutting and in types for crankshaft work, frog and rail cutting, and foundry sprue cutting. Grinders of the fully automatic type for sharpening the blades are furnished in three sizes.

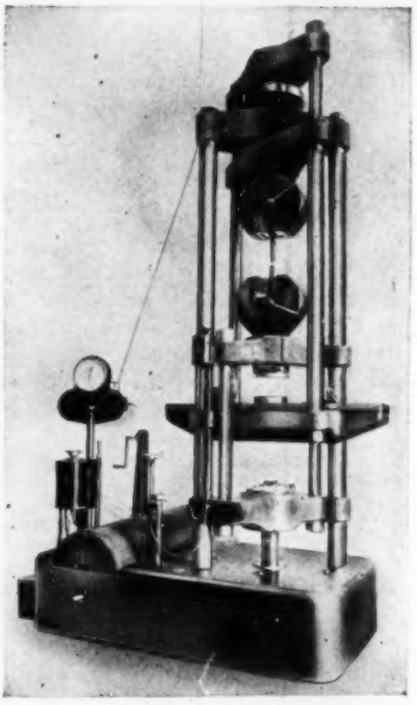


Fig. 2—Losenhausenwerk Model UM Universal Testing Machine arranged for local measuring by a hydraulic gage chamber and Bourdon pressure gage

Losenhausenwerk Universal and Plain Testing Machines

SEVERAL universal and plain testing machines built in capacities from 15 to 1,000 tons and suitable for 80 to 100 tests per hour are being marketed in this country by Alfred Suter, 200 Fifth Ave., New York, N. Y., representative of the Losenhausenwerk Dusseldorfer Maschinenbau A.G., Dusseldorf-Grafenberg, Germany. The universal

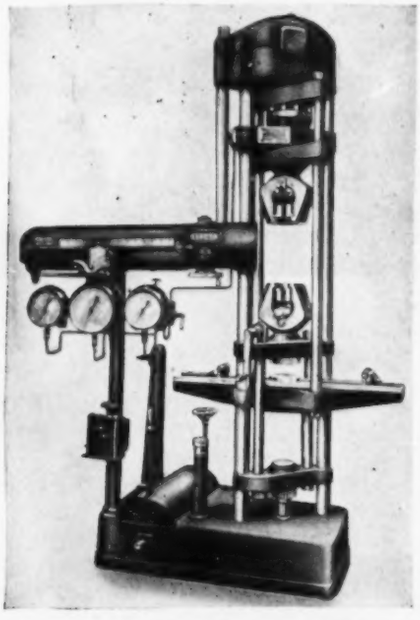


Fig. 1—Losenhausenwerk Model ULM Universal Testing Machine arranged for double load measuring

machines are suitable for tension, compression, folding, shearing, and Brinell tests, whereas the plain units are suitable for tension tests only. Both the universal and plain types are available in three different models. For the former type these are; Model UL for load measuring by a sliding weight balance; Model UM for load measuring by a patented hydraulic gage chamber and Bourdon steel tube pressure gage, and Model UML for double load measuring by a sliding weight balance combined with the hydraulic gage chamber and the Bourdon steel tube pressure gage. The plain tensile testing machine is made in models ZL, ZM, and ZML, which are similar, respectively, to the others as far as the load measuring devices are concerned.

Each unit is built upon a heavy baseplate and all cast parts subjected to heavy strains are of steel. All gripping tools are made of crucible steel. Non-polished and cast parts are finished in baked-on black enamel.

A feature of the line of universal testing machines is the independence of the various attachments, and owing to their design they are always ready for all tests without removing or inserting any of the parts. For tension tests, a pair of rapid grippings heads is used, and by means of these any round or flat test rod with or without shoulders or threads can be gripped without danger of slipping in two operations, consisting of inserting the rod simultaneously into the upper and lower heads, and pulling down on the two handles. After the test the lower head is returned by an electric motor to the original position at 600 ft. per min. for the next test. The combined features of the quick-acting gripping heads and the rapid return of the lower head permit from 80 to 100 tests per hour. Drive of the screws is also by motor, various speeds being obtained at the friction clutch. The motor operates at constant speed for all tests.

As stated previously, load measuring on the Models UL and ZL ma-

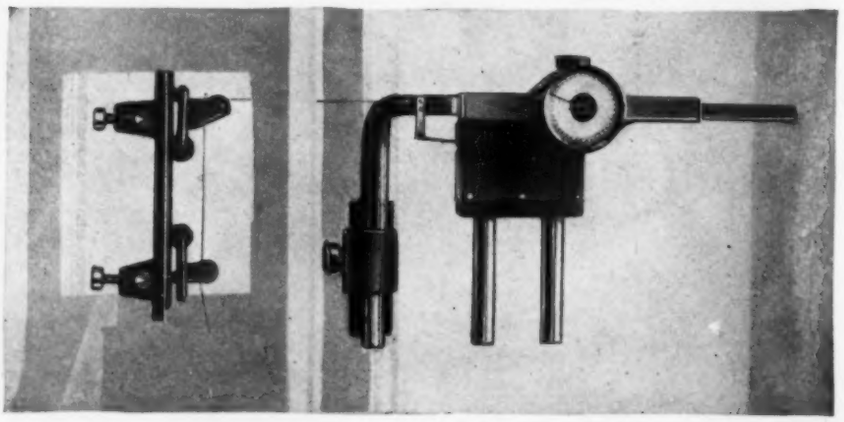


Fig. 3—Automatic Elongation Indicator

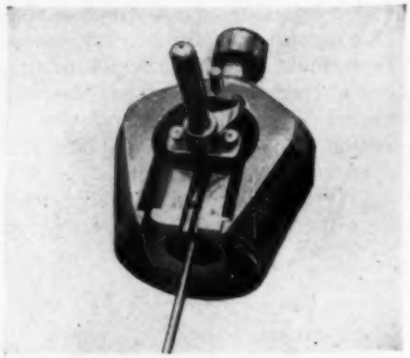


Fig. 4—Universal rapid gripping head for tensile tests

chines is obtained by means of a sliding weight balance. The weight is moved by means of a handwheel and a scale indicates the load. A counting mechanism just above the handwheel and in front of the operator indicates the load for further convenience. This device can also be set to indicate loads in a 10:1 ratio, that is a 100-ton unit can be made to function as a 10-ton machine. The models UM and ZM are fitted with a hydraulic gage chamber and Bourdon steel tube pressure gage instead of the sliding weight balance. The load imposed is indicated automatically in kilos.

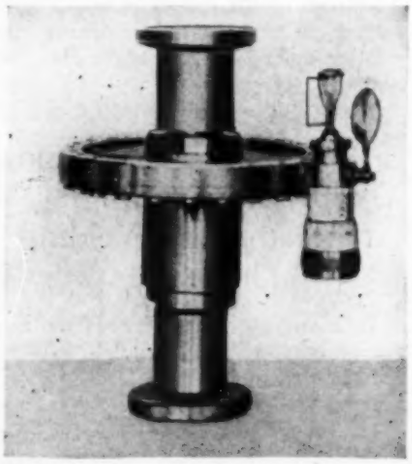


Fig. 5—Tensile load tester

Fig. 6—Pressure load tester

In order to obtain independent check readings of loads, the models ULM and ZLM are fitted with both of the former load measuring appliances. A recording drum is fitted on all units equipped with the hydraulic load measuring equipment in order to show the amount of elongation and the amount of the load throughout the entire test, including rupture. The measurement of the elongation is done by the attachment illustrated in Fig. 3. This device is fastened, as shown, to the two clamps on the test rod and indicates to 0.01 mm. within the measuring range from 0 to 100 mm. The index is fixed automatically at rupture of the test piece so that the total elongation can be measured, not only to the flow point.

Calibrating the testing machines can be done by the portable tensile load tester and the pressure load tester, shown in Figs. 5 and 6, respectively. The design of these testers is such that they can be inserted into the machine with the same convenience as any other test piece. These testers can be obtained for loads from 2,200 to 1,100,000 lb., and they are accurate from 0.1 to 0.5 per cent of the true value. The net weights of the tension type range from 6.6 to 66 lb., and those for the compression type from 5.5 to 242 lb. Their design makes them applicable to hydraulic presses for checking purposes.

Dimensions of the universal machines for the 15- to 100-ton capacities range as follows: Width, 58 to 114½ in., depth, 26¾ to 59 in., height, 82⅝ to 153½ in., the Model ULM being slightly higher. Weights range from 2,200 to 15,400 pounds.

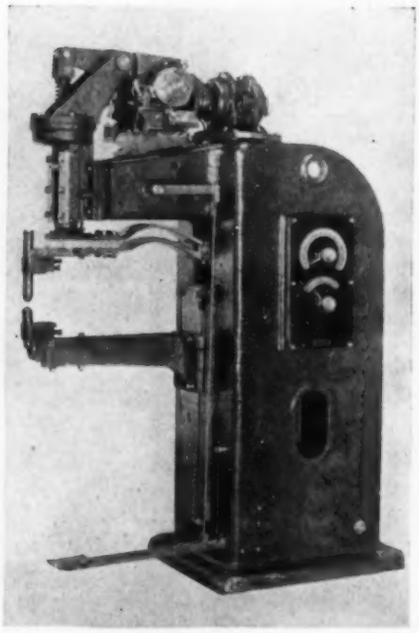
Higgins Improved Pipe Bender

A machine to make 90 and 45 deg. bends and return bends, offsets of any size, coils, ziz-zags, and under-and-over bends in pipe, has been introduced by the J. C. Higgins Manufacturing Company, 2228 Kettner Boulevard, San Diego, Cal. The bends are directly made and can be located anywhere in the length of pipe, which is bent cold, with nothing inside. One-quarter-inch and ⅜-in. pipe are bent on a 2½ in. radius; ½-in. pipe on 2⅝ in. radius; ¾ in. pipe on 4 in. radius; 1-in. pipe, two forms, on 5½ and 7 in. radii. The machine will also handle extra-heavy pipe and electric conduits. It operates by hand-power and is adjusted without extra tools. It is portable, no single part weighing over 60 lb. The total weight is 230 lb., and the bench space occupied is 10½x16 in. The machine comes ready for bolting to the bench and is equipped with right-and-left tilting table, three-point stop, and right-and-left hinge vise. It will operate in several different positions and in a cramped space.

Higgins Improved Pipe Bender

Power Drive Attachment for Thomson Spot Welders

For application to the standard series of medium and heavy-duty spot welders, a power drive attachment has been developed by the Thomson Electric Welding Company, Lynn, Mass. This unit is compact and consists of a 1-hp. motor connected through a three-speed Texrope drive to a gear reduction unit and camshaft carrying a cam for obtaining movement of the upper electrode or welding die. A special adjustable split cam for controlling the current dwell and synchronized with the welding cycle is supplied. The pressure on the welding electrodes is adjustable through a spring. The ways or slides for the upper head are of the rectangular type, adjustable for wear, and these slides are of ample length to insure long life. A vertical adjustment of 12 or 24 in. is available on the lower horn and a special brace for this part, not shown, is supplied for use when welding work that does



A No. 251A 24 Power-Driven Spot Welder equipped with a Power Drive Attachment

not surround the lower horn. This brace is of advantage when welding the heavier gages or when welding flat stampings by the projection method, where large flat-faced dies are used and it is essential that these dies remain parallel at all times.

Control of this attachment is obtained by a multiple-tooth clutch operated through a foot lever. The welder may be operated either as a single stroke press or continuously by keeping the clutch lever depressed. A wide range of welding speeds for different classes of work may be obtained by use of various speed motors and gear reduction units. With the addition of this attachment the spot welders are suitable for single spot welds on light or medium weight stampings, for projection welding of light stampings, and for multiple welds on wire goods articles. The power drive unit may be attached to any standard welder having a throat depth of from 1 to 4 ft., and with transformer capacity of from 25 to 75 kva., ordinarily.

U. S. 24-Inch Die Block Surface Grinder

Especially designed for surfacing die blocks and grinding manholes and flat work of all kinds within a minimum circumference of 24 in., the electric grinder illustrated has been placed on the market by the United States Electrical Tool Company, Cincinnati, Ohio. The motor provided is a 2-hp. Westinghouse type running on SKF ball bearings. The lower bearing is a combination radial and thrust type. The base of the machine is square and its surface is 36x 48 in., and it is provided with T-slots for clamping down the work. The slots do not go around the entire table, but start from the rear and extend about three-fourths of the way across the base.

The upright column is made from

U.S. 24-Inch Die Block Surface-Grinder

a 3½ in. steel tube, 48 in. high. The upright is equipped with a stop collar. The cross arm is also of 3½ in. steel tubing, 36 in. long. The arm holding the grinder is of 3-in. cold-rolled steel and the grinder mounting collar is equipped top and bottom with ball bearings. The mounting has two adjustments, a vertical one of 6 in., and a horizontal one of 8 in. The dovetail slides have adjustable gibs. This machine is equipped regularly with a 6-in. cup wheel and 12 ft. of rubber-covered cable with plug.

General Electric Small Across-the-Line Starter

A manual starting switch, announced by the General Electric Co., Schenectady, N. Y., is designed particularly to meet the demand for a small device which will throw motors across the line. The switch is designated as CR-1038-E-1 and has a maximum rating of 1 hp., 110 volts, and 2 hp., 220 to 600 volts, 3-phase. It consists of a tumbler switch and two small thermal cutouts mounted on a common Textolite base. By means of suitable interlocks, the switch can be locked in either the open or closed position.

Of particular value to the textile industry is the optional use of either single or double pedestals on which

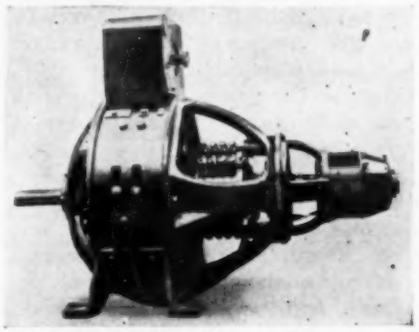
General Electric Small Across-the-Line Starter

the switches can be mounted in positions near the controlled machines. The links of the cutouts are of tinned copper to prevent oxidation and the contact spring and post are also tinplated.

Westinghouse 300- and 400-Ampere Single-Operator Arc-Welding Generators

In rounding out its line of welding equipment the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has introduced 300- and 400-amp. single-operator arc-welding generators of the belted and coupled type, which may be used where driving power such as motors, gasoline engines, tractors, and lineshafting are already available. Speeds of 1,750 and 1,450 r.p.m., clockwise and counter-clockwise rotation, provide ratings for every application.

The unit includes a generator, direct-connected exciter, control panel, and reactor. The generators have small overall dimensions to permit mounting where space is a minimum. The control for the unit is mounted on top of the generator



Westinghouse Single-Operator Arc-Welding Generator

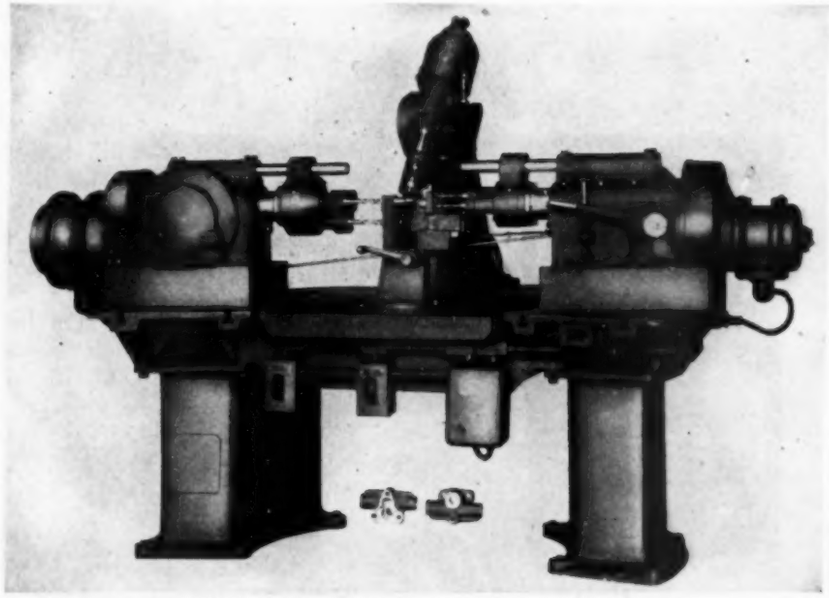
frame and is inclosed by a sheet-metal cabinet. The control includes a voltmeter, ammeter, and a single-dial field rheostat for adjusting the welding current. The welding current range of the 300-amp. unit is 90 to 375 amp., while that of the 400-amp. unit is 120 to 500 amperes.

The welding generators are all of the special type SK, single-operator, constant-current, differentially-compound-wound, separately-excited type. Because of the separate excitation feature, variations of arc length or intensity are automatically compensated for by instantaneous changes of generator voltage. The generators are rated in accordance with the recently revised N.E.M.A. standards, 1 hr. 50 deg. C. temperature rise on a resistance load at 25 volts. While the units are of the single-operator type, multiple-operator generators can be furnished in standard 500, 750 and 1,000-amp. ratings. Larger ratings are available.

Bradford Special Automatic Horizontal Drilling Machine

THREE heads are applied to this horizontal drilling machine, two of the heads horizontally, and another at the rear and inclined, as shown. The machine has been developed by the Bradford Machine Tool Company, Cincinnati, Ohio, for the production of hydraulic shock absorber parts. It is arranged so that the head at the operator's left hand drills two $\frac{3}{4}\frac{3}{4}$-in. holes, $\frac{1}{3}\frac{7}{2}$ in. deep and one 0.557-in. hole, $1\frac{1}{16}$ in. deep. The head at the operator's right hand drills three 0.257-in. holes, $\frac{9}{16}$ in. deep, while the head mounted on the angular bracket at the back of the machine drills a 0.332-in. hole, $\frac{1}{4}$ in. deep. The material is cast iron and the floor-to-floor time is 36 sec. per piece. One boy operates two machines simultaneously.

In the operation of the machine, the operator clamps one part into the workholding fixture and trips the feeding mechanism of the master head by lifting the lever shown at the right. The cam on this head controls the action of the tripping rods shown at the back of the fixture, which makes it possible to trip all heads simultaneously by a single motion. The action of all units is fully automatic and requires no attention on the part of the operator after the feeding mechanism has been tripped. The control of all motors is obtained through a single push button and a feature of the machine is the circular T-slots in the table which facilitate the re-arrangement of the drilling units.



Bradford Special Automatic Horizontal Drilling Machine arranged for producing 100 shock absorber parts per hour

Lufkin Radius Gages

The Lufkin Rule Company, Saginaw, Mich., has brought out a radius gage set consisting of 16 individual gages from $\frac{1}{32}$ to $\frac{7}{64}$ in. radii, by 64ths, all contained in a leatherette folder. Each radius is an individual gage, thus allowing the mechanic to select the particular radius he desires

Set of Lufkin Radius Gages in pocket case

and have it continually available. An added feature is that both external and internal forms are on the same gage.

Armstrong Spring-Type Cutting-Off Tool

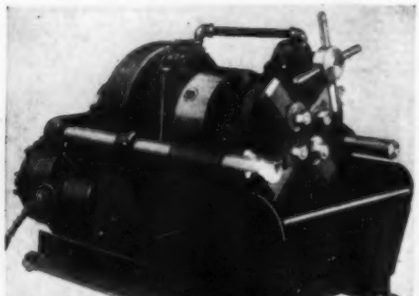
A spring-type, straight-shank, cutting-off tool has been added to the line manufactured by the Armstrong Bros. Tool Company, 315 N. Francisco Ave., Chicago, Ill. The tool body is made from a drop-forged shank and the tool bit is held in position by a screw which can be set

Armstrong Spring-Type Cutting-Off Tool

for any desired clearance. The goose-neck form of the tool gives a resiliency that takes up any chatter and keeps the work from climbing up on the tool.

Toledo No. 999 Pipe Threading Machine

A compact bench-type pipe threading and cutting-off machine has been placed on the market by the Toledo Pipe Threading Machine Company, Toledo, Ohio. It is known as the No. 999 and will take from ½- to 2-in. pipe. It is fitted with a specially designed cutting head with four knives cutting simultaneously.



Toledo No. 999 Pipe Threading and Cutting-Off Machine

Two-inch pipe is cut off in 15 sec., and is threaded in 30 sec. The die-heads can be changed instantly from one size to another and the dies are easily reground when dull.

The universal, reversible, ball-bearing motor operates from a lamp socket. An oil pump is built into the machine and is positive in action. Overload protection is afforded by a friction drive.

Stuebing Cowan "Red Streak" Lift Truck

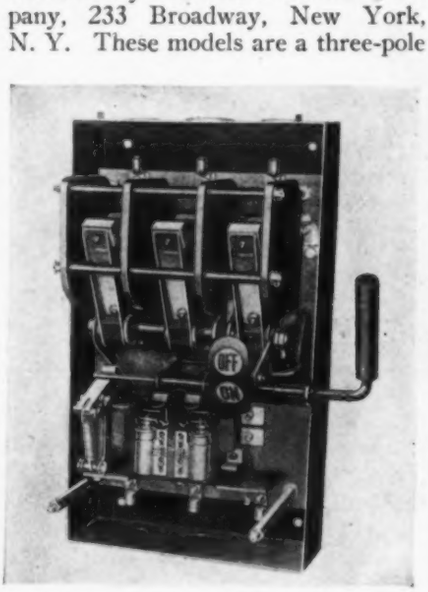
An easy lifting truck of the single lift type and having a capacity of 5,000 lb. has been placed on the market by the Stuebing Cowan Company, Cincinnati, Ohio. Additional power is provided by compounding the leverage on the steering lever, permitting the operator to raise capacity loads

Steubing Cowan "Red Streak" Lift Truck

easily. The "Red Streak" is an all-steel lift truck having four wheels mounted on large ball bearings. The operator can raise the load with the steering lever at the side at any point within an arc of 90 degrees.

Roller-Smith Type EAF Small Circuit Breakers

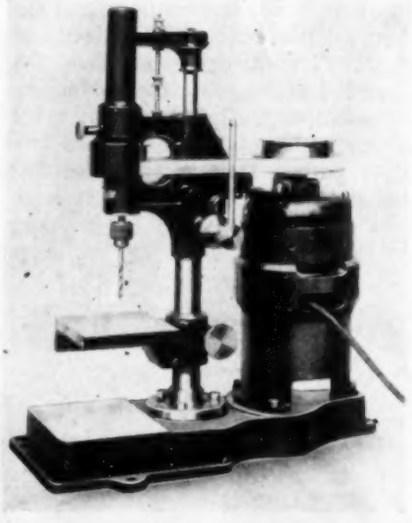
Several models have been added to the line of Type EAF small inclosed air-break circuit breakers manufactured by the Roller-Smith Company, 233 Broadway, New York, N. Y. These models are a three-pole unit with three overload coils, a four-pole model with two overload coils, a four-pole unit with four overload coils, and plain under-voltage, two-, three- or four-pole models. With these additions the line is applicable to nearly every type of service required of this small circuit breaker, which is rated at 80 amp., 550 volts and less a.c., and 250 volts and less d.c. Features are: The overload coils, instantaneous trip, the time delay trip, and the undervoltage device. The free-handle circuit breaker is inclosed in a steel cabinet.



Interior view of a Roller-Smith Type EAF Small Circuit Breaker

High Speed Hammer Company's Model R-53 Sensitive Drilling Machine

The high speed sensitive drilling machine recently introduced by the High Speed Hammer Company, Inc., Rochester, N. Y., is designed to take care of work from the smallest



High Speed Hammer Company's Model R-53 Sensitive Drilling Machine

diameter hole up to ¼ in. On the standard machine the spindle speeds are 2,700 and 5,500 r.p.m. In the type known as the "Toolroom Special," three-step pulleys provide speeds of 1,500, 3,000 and 6,000 rev. per minute.

The spindle is guided by vertical quills supported by annular ball bearings which take the belt pull. Two ball thrust bearings carry the top of the spindle at the feed arm.

Spindle travel can be set by the

depth gage. Maximum travel is 2¼ in. The table can also be adjusted in height, or entirely removed if necessary. A self-cleaning taper keeps the ground main column free from chips. The base has a ground working surface 4x6 in. and will take work up to 7½ in. in height. It has also an oil groove and self-cleaning column support. The front pulley and upper part of the spindle are covered by a detachable guard to insure safety.

Specifications for the machine include: drilling to center of 6-in. circle; base overall, 10x20 in.; height overall, 24½ in.; net weight 108 lb. Standard equipment includes: 110 or 220 single-phase, 25, 50 or 60-cycle a.c. motor, or 110 or 220 d.c. motors; 0 to ¼ in. chuck; 6 ft. of cord and a plug.

"Bonderite," a Primer for Iron and Steel

"Bonderite" is a primer nonmetallic coating, which is sufficiently absorbent to insure perfect cohesion with the applied coating of paint, enamel, or lacquer. It will give a bond that will last from eight to twelve times longer than obtainable without it, according to the manufacturer of Bonderite powder, the Parker Rust-Proof Company, 2177 East Milwaukee Ave., Detroit, Mich. Even when the outer coating is chipped off, no moisture can get under the primer and cause corrosion. Furthermore, the Bonderite coating is opaque and uniform in color so that the finish applied will be uniform. Because but 10 to 12 min. are required for the process, it is suitable for the mass production of automobile fenders, disk and wire wheels, and other parts, and because it is economical in labor costs, not requiring any but unskilled labor for handling, it may be employed by the small as well as the large shops.

Bonderite is available in powder form, copper phosphate being one of the constituents. It dissolves readily in boiling water so that plain open tanks with steam connections may be employed. Because of the short processing time, conveyor installations may be used. The coating is velvety, dark red in color and may be obtained without special preliminary cleaning operations. Certain articles require wiping with a naptha-saturated cloth only, whereas others may require a soda dip and rinsing. Other materials may require scratch brushing, but no sandblasting, pickling or other elaborate cleaning is necessary.

When the work is placed in the tank, evolution of hydrogen takes place, and when it stops the article is competely Bonderized. After the processing, rinsing is required, followed by quick drying and wiping with a tack rag. Where very fine finishes are demanded, a light smoothing with steel wool may be employed. Bonderizing should be applied after all manufacturing operations prior to finishing have been completed.

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

In a machine for cutting double-helical, or herringbone gears, patent 1,709,835 of Paul Bottcher, Hamburg, Germany, the cutter is moved along the flanks of the teeth of a crown wheel and the helix is generated by a relative motion between the blank and the tool-holder.

A sandblast barrel patented, 1,710,167, and assigned to the Rangborn Corporation, has an opening at the end to admit the blast and a means for deflecting the articles in the barrel to be sandblasted. A separate patent, 1,710,166, covers the device for controlling the direction of the abrasive stream into the barrel.

The New Haven Sand Blast Co. was assigned patent 1,710,604 on a rotary tumbling sandblast machine which has a nozzle arranged at the end directing its blast inwardly into a screen spaced in the shell. Another patent, 1,710,612, assigned to the same company, covers a rotary sandblast machine which has a rotary elevator driven at one end of the barrel and blast nozzles at each end of the barrel.

A twist-drill grinding machine patented, 1,710,647, and assigned to the Chrysler Corporation, has an adjustable mechanism for holding the drill so that it will be carried past the grinding wheel at the angle to give the desired rake.

A welding machine patent, 1,714,867, assigned to the Gross Metal Products Co. has co-operating inner and outer electrodes and means for moving the outer electrode against the work.

The National Cash Register Co. was assigned patent 1,714,926 on a cam-cutting machine having a cutter mounted eccentrically, a master cam, and mechanism for transferring the relative motion to the cutter.

The Timken Roller Bearing Co. was assigned patent 1,715,138 on a machine for shearing annular slugs from a tube. The process consists in having plugs inside the tube and positioning the tube to be sheared in alignment with the plug.

A heat-treating furnace patented, 1,715,317, and assigned to the New Departure Manufacturing Co. has a closed heating chamber with a rotating mixer.

Parts and Mechanisms

The E. J. Manville Machine Co. was assigned patent 1,709,876 on a punch holder for a double-blow swaging machine in which the punches are fitted into a way in the gate so as to travel horizontally, but have a vertical movement independent of the gate.

A nut lock patent, 1,709,965, by Floyd M. Williamson, of Detroit, Mich., has simply a C-shaped member instead of a cotter pin, the ends of the C hooking into the hole in the screw.

The Geometric Tool Co. was assigned patent 1,713,319 on a diehead which has spring-actuated plungers for operating the chasers and retaining them by a finger in the clearance position.

A broaching tool patented, 1,713,390, and assigned to the Colonial Tool Co., has grooves cut in the center of the teeth, these grooves being progressively shortened as the teeth are progressively lengthened.

A nut lock, patented, 1,710,117, by John M. Short of Wheeling, W. Va., has a panel in the nut which fits into recesses in the screw.

Materials

Two patents assigned to the Seldon Co., 1,710,019 and 1,710,045, were for molding compounds made from phenols and aldehydes by condensing with an alkali and hardening with a compound containing phosphoric acid.

An anti-friction alloy patented, 1,714,679, by Donald C. Lee, of Spokane, Wash., comprises about 80 per cent brass and 20 per cent Babbitt metal.

A paint and varnish remover in the form of a dry powder was patented, 1,714,530, by Harry D. Tremain and Addie Tremain of Dallas, Texas. It consists of sodium hydroxide, hydrated calcium, fuller's earth, tri-sodium phosphate, red manganese oxide, starch, and methyl-salicylate.

The Dreses Machine Tool Co. was assigned patents 1,715,320 and 1,715,321 on a radial drilling machine covering a

head-clamping device to engage the upper rail when the lever is pulled and also to clamp the lower support. The patents also cover a geared head and drill spindle.

A plastic molding compound patented, 1,710,078, and assigned to E. I. du Pont de Nemours Co., comprised a cellulose nitrate with an ester of phthalic acid and a non-solvent softener.

The Raybestos Co. was assigned patent 1,710,094 on a friction clutch material consisting of incombustible unwoven facing treated with a heavy Mexican asphalt and heat-treated to make the binder insoluble in asphaltic solvents.

An aluminum alloy patented 1,710,148, by Samuel Daniels, of Dayton, Ohio, contains 2.25 to 3 per cent of copper, 0.75 to 1.5 per cent of iron, and small amounts of silicon and magnesium.

Trade Publications

BLOWERS, CENTRIFUGAL. The Allen Air Appliance Co., Inc., Grand Central Terminal, 452 Lexington Ave., New York, N. Y., has published bulletin A-50 giving the characteristics and capacities of the "Triple A" centrifugal compressor, which is suitable for delivering air at from ½ to 15 lb. per sq.in. Several set-ups are illustrated. The catalog contains ten 11 x 8½-in. pages.

COATED ABRASIVES. The Behr-Manning Corporation, Troy, N. Y., has issued Price Book No. 1 on coated abrasives, which may be obtained in sheets and rolls having a facing of various abrasive grains. The various numbers available, together with prices and uses are given. The catalog contains 24, 10⅝ x 7¾-in. pages.

CONVEYORS. The Mechanical Handling Systems, Inc., 3454 Denton Ave., Detroit, Mich., has published a book entitled "Conveyor Facts," which discusses cost reduction through mechanical handling, where the conveyor fits in, and whether it will pay for itself. It gives savings made by various companies through the proper selection of conveying equipment. The catalog contains 63, 9½ x 6-in. pages.

COUNTERSINKS. The National Twist Drill & Tool Co., Detroit, Mich., has published a small bulletin showing several types of combined drills and countersinks. They are: With a No. 1 taper shank, to fit blacksmith's drill presses, a special "bell" type, and three other standard types. The available sizes are listed.

COUPLINGS, FLEXIBLE. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has published circular 1838 on the type E flexible coupling, describing the construction, application, and maintenance of this type, which is designed for use with speed reducers.

DRILL JIGS AND DRILL HEADS. The Siewek Tool & Die Co., Detroit, Mich., has published a catalog showing the various types of rapid drill jigs and drill heads manufactured, together with diagrams and dimensions. The catalog consists mainly of large clear photographs showing the various types.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has published a series of bulletins as follows: Bulletin 214-A, superseding 214, on helicoil sheath-wire immersion heaters; Bulletin 881-B, superseding 881 A, on the type WD-200 A arc welder, gas-engine driven; Bulletin 994-A, superseding 994, on a travel carriage for automatic arc welders; Bulletin 1118, superseding in part 48610, on two-stage reciprocating air compressors, types CP, CPQ and CPT-26; Bulletin 1119, superseding in part 48610, on reciprocating air compressor sets, single-stage, stationary; Bulletin 1120, superseding in part 48610, on reciprocating air compressors, two-stage, stationary, and Bulletin 1121, superseding in part 48610, on reciprocating air compressor sets, single-stage, portable. These sheets are 11 x 8½ in. in size and are suitable for loose-leaf binders.

GRINDING MACHINES. The Dumore Co., Racine, Wis., has published a booklet entitled "Precision Grinding" which illustrates the use of the Dumore grinder on a bench lathe, on an engine lathe, on drill presses, and for toolroom work and other applications. The bulletin contains 31, 7½ x 5-in. pages.

GRINDING WHEELS. The Blanchard Machine Co., 64 State St., Cambridge, Mass., has published a bulletin entitled "Blanchard Wheels", which contains a table showing the recommended wheels for each class of work and a number of pictures of typical Blanchard set-ups, with the wheel data given under each. The bulletin contains fourteen 7½ x 5½-in. pages.

PANELBOARDS. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has published Catalog 224 on panelboards, and gives photographs and dimension drawings to illustrate each type. The price lists are also included. Information as to wire sizes and wiring data for motors are also appended. The catalog contains 64, 11 x 8½-in. pages.

POWER TESTING INSTRUMENT. General Electric Co., Schenectady, N. Y., has published a bulletin on the No. 20 recording instrument for measuring the power input on various motor-driven machines. The method of testing used and making corrections in the installation are treated.

PUMPS, ACID. The U. S. Stoneware Co., 50 Church St., New York, N. Y., has published Bulletin No. D, describing its line of centrifugal acid pumps, which are chemical stoneware lined. The advantages of construction, materials utilized, and cross-sctional views, are furnished. The bulletin contains specifications for the various sizes.

SHEET AND PLATE MACHINERY. The Streine Tool & Manufacturing Co., New Bremen, Ohio, has published a bulletin showing various power squaring shears, corrugating and clipping machines, tin mill shears, corrugating, brake, and toggle presses, and various special machinery. Each type is illustrated and the important specifications are listed.

ARC WELDING PRACTICE. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has published a folder known as publication D.M.F. 5156 which gives a wide range of uses of electric arc welding in the maintenance field and illustrates various types of repair jobs for which the electric arc process is suitable. Data on various types of welding outfits are appended.

LUBRICATION, INDUSTRIAL. E. F. Houghton & Co., Third, American & Somerset Sts., Philadelphia, Pa., has published a booklet entitled "Houghton on Industrial Plant Lubrication," which is the first of a series of booklets on the subject prepared by the company's research staff. The booklet is replete with illustrations of machinery requiring certain types of lubrication apparatus. It contains 56, 9x6-in. pages.

PIPE NIPPLES, STEEL. The U. S. Department of Commerce, Bureau of Standards, has issued Commercial Standard CS5-29 in its program of elimination of waste of steel pipe nipples. The bulletin contains tables of dimensions for standard, extra strong, and double extra strong pipe, taper pipe thread dimensions, stock sizes and lengths of standard and extra-heavy black pipe nipples, stock sizes and lengths of standard weight galvanized pipe nipples, and the packing of standard weight black or galvanized steel nipples.

PRODUCTION METHODS RESEARCH. The Metropolitan Life Insurance Co., 1 Madison Ave., New York City, is issuing through its Policy Holder's Service Bureau a bulletin entitled "Bettering Production Methods Through Research," which is the last report to be released in the "Better Business Through Research in New England" industry study. Seven other booklets on research in various business activities have been prepared as follows: Sales analysis, marketing and merchandising, advertising, aid to sales management, developing old products and introducing new ones, and standardization and simplification.

News of the Week

Chicago Machine Tool Distributors Meet

The Machine Tool Distributors of the Chicago District, held their monthly meeting on Friday, June 21, at the Illinois Athletic Club, Chicago. R. S. Dean, Chicago manager of Manning, Maxwell & Moore, Inc., was appointed chairman for the evening, and the guests of honor were: Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, and Wilson P. Hunt, president of the Moline Tool Company.

This group of distributors is operating under what is known as the Chicago Plan, which is being used not only in Chicago, but also in several other machine tool districts of the country. The plan is well organized and operating very successfully.

Mr. DuBrul made some timely remarks concerning the possibilities of activities which can be undertaken by such a group, principally along the line of statistics which might be accumulated and become of great benefit to the machine tool distributors operating in the district. He endorsed the Chicago Plan, stating that all of the comments from the outside, either by manufacturers, or other interested parties, had been very favorable, and expressed his pleasure at the direct way with which the various problems were discussed and settled.

Joseph T. Ryerson & Son Announces Appointments

Edward L. Ryerson, Jr., president of Joseph T. Ryerson & Son, Inc., announces a number of new elections and appointments to the executive staff of the company. A. M. Mueller, who has been associated with the firm for 30 years in the accounting and sales departments, becomes assistant secretary and a member of the board of directors. He was manager of the St. Louis plant from 1914 to 1917, and later general manager of sales. H. B. Ressler succeeds Mr. Mueller as general manager of sales. Mr. Ressler's experience covers 25 years as manager of the mill order department and manager of the St. Louis plant.

Robert C. Ross is advanced from general traffic manager to assistant to the president, in charge of plant operations. All operating and service functions are thus combined under one head. Mr. Ross has had 26 years' experience in the operating, service and traffic departments. From 1923 to 1929 he was chairman of the Midwest Shippers' Advisory Board. Wm. H. Bryant, with 23 years of service with the company, becomes Chicago sales manager in charge of country and city store sales. He was formerly assistant manager of sales in charge of the Chicago country territory. Guy H. Rumpf, formerly manager of plant operations, succeeds Mr. Ressler as manager of the St. Louis plant. He has been with the company for 17 years. Harry W. Treleaven, with a record of 20 years' service, has been elected assistant treasurer.

Gear Manufacturers Re-elect Officers

At a meeting of the Executive Committee of the American Gear Manufacturers Association held in New York on June 10, the present officers were re-elected for the association year 1929-30. These officers are: President, A. F. Cooke, vice-president of Gears & Forgings, Inc., Pittsburgh Branch; first vice-president, B. F. Waterman, Brown & Sharpe Manufacturing Co., Providence; second vice-president, E. W. Miller, Fellows Gear Shaper Co., Springfield, Vt.; and treasurer, Warren G. Jones, president of W. A. Jones Foundry & Machine Co., Chicago. It was decided to hold the semi-annual meeting of the Association on October 24-26 at Briarcliff Lodge, Briarcliff Manor, New York.

Brown & Sharpe Forms Sales Organization

The Brown & Sharpe Co., a new corporation, has been formed to handle the sales of machinery and tools manufactured by the Brown & Sharpe Manufacturing Co., of Providence, R. I., in the Detroit, Cleveland and Cincinnati territories. The Detroit office is located at 2842 West Grand Blvd. and is in charge of R. W. Dixon, with J. G. Swinburne, machine tool representative and R. R. Grimes, small tool representative. The Cleveland office is located in the Penton Building at West Third and Lakeside Avenue. W. H. Stewart is machine tool representative and J. H. Devlin, small tool representative. The Cincinnati office is located at 814-815 Chamber of Commerce Building and is in charge of G. C. Newell, machine tool representative with J. A. Waterman and R. W. Blakey as associates. All small tools and cutters will be distributed through the hardware and supply trade as formerly.

Boiler and Radiator Makers Organize

Manufacturers of boilers and radiators throughout the United States have, through an executive committee formed for the purpose, organized a trade organization to be known as the Institute of Boiler and Radiator Manufacturers, the membership comprising approximately 100 per cent of the manufacturers of low-pressure boilers and radiators in the country.

The new organization was formed along the lines of those already existing in the petroleum, rubber, and copper fields, and will begin operations immediately on a program of activities suggested at the trade conference of the heating and plumbing industry held at Pittsburgh, May 15. Officers of the Institute are: H. T. Richardson of the Richardson & Boynton Co., chairman; Grant Pierce of the National Radiator Corporation, vice-chairman; and F. W. Herendeed of Geneva, N. Y., secretary and treasurer.

Standardization of Die Sets Planned

A plan for the standardization of die sets has been outlined by Technical Committee No. 9 of the Sectional Committee on Standardization of Small Tools and Machine Tool Elements, operating under the sponsorship of the A.S.M.E. The nomenclature of various parts of punch and die holders was discussed at a recent meeting, and the types classified. Sub-groups of the committee were designated to review and develop proposals on sizes and dimensions, and materials and styles of die sets. The committee has recommended that its name be changed from "Punch and Die Holders" to "Die Sets."

Wire Rope Research Under Development

Representative manufacturers and users of wire rope have organized a group to consider a program for research on the properties and uses of wire rope under the auspices of the A.S.M.E. and the sponsorship of the Engineering Foundation. A tentative program will be circulated for criticism among those interested.

Automobile Production Still High

May production of motor vehicles in the United States as reported to the Department of Commerce was 603,969, of which 516,055 were passenger cars, 86,596 trucks and 1,318 taxicabs, as compared with a total number of 621,331 vehicles in April and 425,783 in May of last year. Production totals for the first five months of 1929 are 2,677,781 vehicles as against 1,804,725 vehicles for the same period last year.

BUSINESS BAROMETER..... *Viewed in its entirety the outlook seems satisfactory, but long-time commitments are unpopular and action on the tariff is awaited*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

CONTINUATION of good business in the machine tool and machinery fields marks the reports received from important industrial centers. In the Chicago district, inquiries are increasing, although sales have dropped slightly. Machine shops and automobile and accessory plants are making purchases. In Cincinnati, June is good, with inquiries active and sales of single tools strong, especially to general machine shops.

THROUGHOUT the South, textile plants, railroads, and contractors are buying, but road-building machinery has slackened in demand. New England business in machine tools is steady and strong. Orders are being quoted for fall delivery. In Indianapolis, small tools are selling fast. Construction, woodworking, and garage equipment, and especially machines for repairs at airplane fields, are in demand. The New York area is unusually active, with electrical industries and railroads buying, but airplane industries showing a recession. In Canada, automotive plants are a little slack, but iron and steel plants, and building and highway construction, are very active. The Canadian Car Co. is furnishing 106 street cars for the Montreal Tramway Co., and has other orders running into the fall. Algoma Steel Co. is building a $2,500,000 plant addition. Detroit is the only district showing summer depression.

IN GENERAL, high industrial activity is bringing an unusually large volume of business to the machine tool industry, with plant expansion apparently accounting for most of the demand.

A MOSCOW despatch, published in the New York *Times* last week, announces that the Soviet Government has decreed a "360-day work year." This decree has been issued in an effort to lift the industrial and agricultural production of Russia from the low minimum to which it has fallen as a result of the many holidays that have been hitherto observed. It is said that the Russian factories have rarely worked more than 250 days a year, after allowing for Sundays and the religious and political holidays that were meticulously observed.

This statement suggests a comparison between the working time in the United States and Russia. In most states of the American Union there are 12 legal holidays each year. There are also 52 Sundays and 52 Saturday half-holidays that are practically whole holidays for many workers. Most employers now give their employees two weeks' holiday with pay, and many workers are absent an average of two weeks additional on account of illness or death in the family of which they are members. This is a total of 144 non-working days, which would leave only 221 productive days in the American workers' year.

But despite the fact that the Russians are already working more days than their American competitors, the Russian production is insufficient while that of the United States is excessive. This apparent paradox was brought out clearly during the debate on the farm relief bill, and it is likely to attract wider attention when the tariff bill comes up for discussion.

The explanation is, of course, America's widespread use of labor-saving machinery, with which Russia has not yet provided herself. If the latter country should ever be able thoroughly to mechanize her industry and agriculture, the result might be amazing, but such changes do not come rapidly, and the present generation of American industrialists need fear little from their Russian competitors.

But this statement is hardly true of Russian grain production. Through the enterprise of the American companies that make agricultural implements and automobiles, the farmers of Russia are being rapidly supplied with tractors, combines, and other farm implements, and the time seems to be near at hand when their competition in grain-growing will be keenly felt by our western farmers.

It is for this reason that the recent declines in the American grain markets attracted so much attention. It is feared that, with a "20th century peace," Russia may again become a great exporter of grain, and a formidable competitor of the United States and Canada in the wheat markets of the world. The result would be a further reduction in the price obtainable for our exportable surplus, and a consequent impairment in the purchasing power of our farmers.

If it is possible for the American farmer to recover his prosperity or have it retrieved for him, then there need be no fear for American trade and industry. But the prices now in prospect for this year's crops are far from satisfactory, and an appropriation from the United States Treasury, however large it may be, will not permanently correct the economic disparity between industrial and agricultural conditions in this country.

The stock market has recently been relatively quiet, if firm. Money is somewhat easier. Speculation seems to be unusually quiet, and a good many stock exchange houses are reducing their forces.

The same may be said of many of the security markets in the Middle West and on the Pacific Coast. The excitement that prevailed in some of them seems to have entirely subsided, and bankers who loaned money on some local securities are said to be demanding its return.

Distributive trade in staples is fully up to the average, and in some lines a capacity output is reported. This is true of steel, agricultural implements, railroad equipment, and some varieties of building material. There is no unemployment. At least there is work for everybody who is willing to labor, but the number of those who seem to think they are able to take a holiday is amazing.

A slight reduction in the output of automobiles is admitted, but it is seasonal. At 18 cents, the demand for copper is excellent, but the supply seems adequate. Rubber is steady at around 20 cents. Sugar is slightly higher. Most of this year's Cuban crop has been sold, and the production next year will be small unless prices are higher.

Silk has been quite active, and there are some who say that we have very exciting times ahead of us in the market for silk futures. Continued improvement in the shoe and leather trade is reported, and the demand for low-priced clothing is said to be surprisingly large.

Cotton has been quiet at 18½ cents for July contracts. The proportion of next year's crop that has been contracted for is probably the smallest on record. The cotton goods market is steady, and most dealers maintain that conditions are better than the mills admit. Certainly this is the only rational basis for the large May consumption.

Viewed in its entirety, the outlook seems to be satisfactory, but long-distance commitments are unpopular, and there is a general disposition to await the reconvening of the Senate on August 19, and its action on the tariff bill.

European observers are optimistic about conditions overseas, and the United States will be delighted to welcome Ramsay MacDonald when he arrives here to visit President Hoover.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

DETROIT

With the exception of an occasional small flurry the machinery and machine tool market in the Detroit district has settled into a definite summer depression.

Automobile manufacturers have been buying almost nothing of importance, and there is no immediate prospect of any large orders. Last week one dealer reported a sudden run on small equipment and tools, but this was by no means general, and the dealer reported that the business would bring his total June sales to a point only a little higher than the total for May. It seems doubtful if the month of June, in general, will compare favorably with May.

Few inquiries are being received at present, and most of these are coming from the small shops which do work on contract. This seems to indicate that the shops anticipate new work from the automotive industry in the near future. In general, this is an exceedingly dull period with almost nothing of interest or significance to report.

CANADA

There has been little change in the machine tool and machinery situation in Canada during the last fortnight. With the exception of a seasonal slackening in the automobile industry, which also is reflected in accessories and allied lines, conditions have been fairly satisfactory. Iron and steel industries are flourishing and the car companies are all well employed. The Canadian Car and Foundry Co. has commenced delivery of 106 new street cars to the Montreal Tramway Co. In addition to this extensive contract, Canadian Car has sufficient orders to keep the plants working at capacity until the fall, at least.

Building and construction continues unabated, with the result that demand for contractors' equipment is brisk. The electrical supply firms report an unusually busy season and the belief is prevalent that the demand for electrical equipment will continue to grow as the season advances. Makers of road-building machinery are also enj ying a good season. Never before in the history of the Dominion has there been as extensive a road-building program as this year. Millions of dollars are being spent in practically every province for highway improvement.

The Algoma Steel Corporation has commenced the extension of its 12-and-18-in. merchant mills. This work will involve an expenditure of $2,500,000. The new machinery will be installed about the first of October.

CHICAGO

Business in machine tools during the last week is reported to be on a slightly lower level than that of the week preceding, although, inversely, inquiries received for the same period show an increase in volume. Most of the orders now being booked are reported to be from industrial concerns. Machine shops are in the market, and automotive and auto accessory manufacturers still constitute a not unimportant factor. Makers of farm machinery and tractors, of late, have been limiting their buying to single tools and small lots. Some of the Western railroads still are sending in inquiries for new shop equipment, but practically all of the Western roads that issued lists during the first months of the year, have to a large extent, cleaned up on requirements.

The recession referred to has not been unexpected by the trade, and the opinion is general that from now on, until the vacation period ends, the annual seasonal let-up will be experienced, but in a lesser degree than in previous years. Very little improvement in deliveries is reported, but the opinion is expressed that almost normal production conditions will be resumed toward fall. Dealers in used tools report business as only fair.

NEW ENGLAND

The current week has been extremely hot with results in the New England machine tool market that might serve as a fair criterion of what may be expected in the industry through the torrid season. If the week past is an accurate barometer of business for the summer, the trend should be steady. There was a good amount of prospective business in evidence and prominent buying of special machinery and foundry equipment. The usual good distribution of small machines and shop tools was also in evidence. The closing days of June have found buying quite spirited somewhat above the level that featured the first of the month.

Orders were noted from the automotive industry, but were for single tools for replacement purposes. More pronounced buying from this source is anticipated when manufacturers complete plans for changes in their product. Some of this business may develop before fall. Bearing manufacturers have been steady purchasers of machinery and recent mergers and planned expansion within this field indicates further business from this source. Construction continues at a good level in industrial sections, and embraces machine shops, service garages, aeronautical units and general manufactories.

Most new orders, following a general routine, are being quoted for fall delivery. Substantially then there is not much improvement being made in the delivery situation, although better deliveries are sometimes obtained under pressure. Grinding machines remain a prominent factor in New England sales, but all types and sizes of machinery are represented in the buying. Heavy equipment sales lag in some instances.

NEW YORK

Dealers and manufacturers' representatives in the New York district report, in most cases, that the demand for machine tools is holding to a high level throughout June. Inquiries also are good. Since the latter part of the month is usually better than the first, the general outlook is that June will approach close to, if it does not equal the record of May. Aside from a possible let-down due to vacation influences, no great summer slump is anticipated.

Deliveries are still slow. A few lines show slight improvement, while some have fallen still further back. Some standard machines are now being quoted for December delivery; radial drills run to October and November, and horizontal boring mills to December and January. No new price changes have been announced. One maker of power hack saws placed a price increase in effect on June 15.

Buying is still well distributed, both as to equipment in demand and types of industries making purchases. Most orders are for one or two machines. Turret lathes are moving unusually well. Small tools are in great demand, sales are large in this field, and delivery is good. Plant expansions seem to account for most orders, so that a potential market for replacements probably is building up, to be tapped later in the year.

Among the large purchasers in this territory, the General Electric Co. and the New York Central Railroad are active on the market. Sheet metal plants and electrical instrument industries are also buying. The Nichols Copper Co. list, opened in January, shows signs of developing into purchases. Aircraft factories and aircraft accessory plants appear to have experienced a slight recession and are not buying at present.

The used machinery market has been unchanged for several weeks. Inquiries and orders are good, and well spread, prices are holding and deliveries are fair, where the equipment in demand is available. June sales, however, tend to fall slightly below May.

Sales reported by the Triplex Machine Tool Co. for the past two weeks are: two Swiss jig borers, one Ames bench lathe, one Campbell nibbling machine, one universal spring coiling machine, one small engine lathe, two drill presses, two floor grinders, and one arbor press.

CINCINNATI

The great majority of the machine tool manufacturers of the Cincinnati district report that in the past week there was no material change in business conditions and sales remained at the good level of the previous week. However, there were a few who reported a slight increase in sales, but this was largely offset by decreases reported by a few others. Manufacturers of large tools, who gage business by the month, not by the week, state that so far June has been an excellent month, and estimate that it will show a gain.

Selling agents report that there was no appreciable change in the demand in the past week, there being enough sales coming in to keep business on an even keel. While the needs of buyers in local and adjacent territory were largely confined to single items, the aggregate sales formed a satisfactory volume.

While here and there the manufacturers received an order for two or three tools, in the great majority of cases the requirements of buyers were confined to single tools and replacements.

Inquiries flowed in freely during the week, the great majority being from general machinists and miscellaneous users, located in all sections of the country, whose requirements were largely confined to single tools and replacements, well diversified as to sizes and types. Business booked, together with orders coming in, will, it is thought, sustain manufacture at a good level for a considerable period.

INDIANAPOLIS

Little change has been seen in the machine tool or machinery business during the last two weeks. There is not the volume there was during the first quarter, but there is a steadiness in the demand that probably will make the total sales volume of the second quarter of this year ahead of the same period last year.

However, there are bright spots. One of the brightest at the present time is the volume of small tools that is being sold to the airplane industry, particularly pri-

vately and publicly-owned airfields. This business is particularly gratifying to the trade because it is comparatively new in Indiana and is growing by leaps and bounds. It seems that every town of any consequence in the state is determined to have a landing field and each landing field is being equipped with adequate hangars and facilities for making ordinary repairs.

Demand for construction equipment also is improving. A large volume of special machinery is being sold to road contractors, who for the first time during the season are finding weather conducive to work. The same is true of the building contractors.

The last two weeks has seen some decrease in demand from the automobile industry. Practically all equipment has been purchased for the summer production of new models, and all that will be required now is for replacements. The demand from this source during the year has been good, however, above that of last year.

The demand for garage equipment is active and likely will remain so during the summer. A steady demand also is noted for special machinery for woodworking plants. The furniture trade is buying its requirements and the radio cabinet factories seem to be especially busy.

SOUTHERN DISTRICT

There has been but little change in the machinery and machine tool situation in the southern district the past two weeks, dealers and distributors stating that business is about on a par with that at this time last year, but that the summer outlook is less promising, considering the situation as a whole. In some of the industrial fields, however, the outlook seems to be unusually good.

As has been the case for some months past, the textile mills continue to be among the largest buyers, and they are placing sizeable orders for both raw and used, or rebuilt, equipment to be used in the new mills now being erected in this district, most of this construction being in the Georgia, Alabama, East Tennessee and Carolina territory. Furthermore, the outlook is very good in this field, and there appears to be no indication of abatement in this demand for some time.

Railroads are also placing some fairly good orders for heavier equipment in the same territory, and the outlook for summer business is also very good as the larger roads are making large investments in shop construction at this time.

Some orders are being reported for road-building machinery in the different southeastern states, but this business is not as active as it was three or four weeks ago. Sales of contractors' equipment are holding up well in the larger cities of the southeastern district because of the abnormal amount of new construction in those centers, but are rather inactive in the smaller towns and communities.

A few orders are being reported by the distributors from the smaller machine shops and garages, but they are mostly orders of rather small size and for used or rebuilt equipment, though inquiry seems to promise an improvement in demand from this source in the next few weeks.

Business Items

The Arrow Head Steel Products Co., of Minneapolis, Minn., has under construction an addition which will increase the present floor space 100 per cent. Equipment to the value of $200,000 will be installed. The company expects to have this new section ready for occupancy by July 1. The new section will be devoted exclusively to the production of wrist pins and the old building to pistons. The company is also contemplating the erection of a new plant at Buffalo.

Further expansion of the McKinnon Industries at St. Catherines, Ontario, is to be undertaken by General Motors of Canada, which recently acquired control. R. S. McLaughlin, president of General Motors, intimates that it is the intention of the company to launch out into the manufacture of electrical equipment, transmissions, shock absorbers and truck axles in addition to the axles and other parts of automobiles at present turned out. Additions are to be made to the St. Catherines plant.

The Patterson Steel Products Co. is being newly organized at East Liverpool, Pa. Construction of a new $100,000 factory has been started, with completion scheduled before fall. D. G. Rhue, of the Alliance Tank Co., and Morgan Engineering Co., of Alliance, Ohio, and R. L. Cawood of the Patterson Foundry and Machine Co., are officials in the new concern.

The Gilby Wire Co., 150 Riverside Ave., Newark, N. J., has begun the construction of two new factory units to cost $100,000. The buildings are 90 x 160 ft. and 28 x 50 ft., of one-story, steel-frame construction. They will be ready for occupancy in August. The Austin Co. has been awarded the contract for the design and construction of the buildings.

Shawinigan Stainless Steel and Alloys, Ltd., a subsidiary of the Shawinigan Water & Power Co., has commenced operations at Shawinigan Falls, Que. Control of the new company is held by Shawinigan Chemicals, Ltd., and the foundry is the first in Canada to confine itself to the manufacture of alloy steel castings of all descriptions.

The Copperweld Steel Co., Glassport, Pa., has formed a southeastern sales district comprised of Georgia, Alabama, Tennessee, Florida, Mississippi, and part of Louisiana, with P. A. Terrell in charge as district manager. The office of this district is located in the American Traders Bank Bldg., Birmingham, Ala.

The Youngstown Tank and Boiler Co. has purchased a factory building in East St. Louis, Ill., where it will produce steel tanks, fabricated field tanks, and miscellaneous plate construction up to ½-in. thickness. Additional improvements costing $75,000 will be made at once. The plant will have a capacity of 500 tons per month.

The Superior Trolley Slide and Adjustment Co., Rockford, Ill., has been granted articles of incorporation for $100,000 and will engage in the manufacture of electric railroad equipment. Leroy S. Kussy, Ottc E. Ritzman, George H. Owens, Kenneth M. Wilkens and Earl P. Schultes, are the incorporators.

The General Fireproofing Co., of Youngstown, Ohio, will erect a plant to cost in excess of $300,000 to house a new department where aluminum chairs will be manufactured. The new plant will adjoin Plant No. 1, will have 900,000 sq.ft. of floor space and will provide employment for 250 to 300 additional men.

The Taylor Iron Works & Supply Co., Macon, Ga., manufacturer of machinery and metal products, and distributors of several well-known tool and machinery lines in the southeastern territory, has started the construction of a structural steel shop to operate in connection with the other units of the plant, and also plans to erect two more units later on this year that will enable the company to still further increase its capacity.

The James Hunter Machine Co., North Adams, Mass., has started work on an addition to its plant. The new building will be of steel and brick. It will provide increased manufacturing space, and also permit a rearrangement of the plant to improve manufacturing facilities.

The Crescent Machine & Tool Co., Inc., was organized and incorporated this month at New Orleans, La., for the distribution of machinery, machine tools and mill supplies in that district. One of the officials of the company is William J. Ferris, 4233 Banks St., New Orleans.

The Iowa Boiler Works, in operation at Ft. Dodge, Iowa, the last 13 years, has merged with the former Iowa Machine Shop, which has been inactive the last 18 months, as the Iowa Machine and Boiler Works. S. W. Smith becomes manager of the new company.

The Berliner-Joyce Aircraft Corporation, Baltimore, Md., has opened a new factory at Dundalk, adjacent to the Baltimore municipal airport. The Baltimore office, and the factory equipment at the old plant at Alexandria, Va., have been moved into the new factory.

Mechanical Handling Systems, Inc., of Detroit, Mich., has opened an Eastern office at 501 Fifth Ave., New York City. The office will handle engineering, estimating, and sales, of conveyor installations.

The Midland Steel Products Co. has appropriated $175,000 for the improvement of its Cleveland works, according to a recent announcement by President E. J. Kulas.

The Curtiss-Caproni Corporation, New York, has announced plans for the construction of a manufacturing plant for sea planes at Baltimore. The estimated cost is $1,000,000.

The Miller Printing Machinery Co., Pittsburgh, Pa., manufacturer of printing presses, will build an addition on property purchased adjoining its present plant.

The Hayes Custer Stove & Furnace Co., Bloomington, Ill., recently suffered a fire loss, estimated at about $100,000, to its foundry and furnace plant.

The Boston Gear Works Sales Co., after July 1st will occupy Cleveland offices at 211 St. Clair Avenue, N. W.

Personals

G. H. HOWARD has been elected a director of the John Bertram and Sons Co., and Pratt and Whitney Co. of Canada. Mr. Howard was born in Dundas, Ont., and served his apprenticeship with the John Bertram and Sons Co. Following this training, he worked in Hamilton, Ohio, Cincinnati and Philadelphia, gaining extensive experience in shop methods. He returned to Canada as a toolroom foreman for the Cleveland Bicycle Co. in Toronto and remained with that company seven years. Later he joined the Fairbanks Morse Co. as machine tool salesman in British Columbia. He later joined the A. R. Williams Machinery Co. of Toronto and remained with them seven years. On January 1, 1913, he returned to the John Bertram and Sons Co. as sales engineer.

FRANK W. CURTIS, for the past several years western editor of *American Machinist* with headquarters at Chicago, is now chief engineer of P. R. Mallory & Co. Inc., of Indianapolis, Ind. The company manufacturers Carboloy cutting tools for the Carboloy Co., and Mr. Curtis will be in charge of complete manufacturing at the Indianapolis, Detroit and Newark (N. J.) plants. At one time he was chief engineer of the Dowd Engineering Co., New York, and is author of "Tool Engineering," "Modern Gaging Practice," and "Cutting Speeds and Feeds."

WILLARD A. JOHNSON has been appointed manager of the Eastern offices of the National Acme Co., 117 Liberty St., New York City, to succeed Harry T. Latto who resigned on June 16. Mr. Johnson has had many years of sales experience with Acme company, having been at one time connected with the Eastern offices and later representing the company in the Ohio territory. The territory now under Mr. Johnson's supervision includes New England, eastern New York and Pennsylvania, New Jersey, Delaware, Maryland, the District of Columbia, and Virginia.

A. W. CASH, manufacturer and inventor of valves has sold the assets and business of the Apex Regulator Co., Decatur, Ill., to the Fisher Governor Co., Marshalltown, Iowa, and has signed a five-year contract with the Fisher company as engineer. The Decatur concern, will continue to operate as a separate entity, it is said, the Fisher company manufacturing and handling a line of larger valves. Mr. Cash has been in the manufacturing field 40 years and organized the Apex company last year.

J. W. TAMBERT, who for nearly five years has been in charge of the cost and manufacturing departments of Perfex Corporation of Milwaukee, Wis., manufacturers of heavy duty radiators, has been advanced to the post of secretary and treasurer, succeeding C. G. Phelps, resigned.

WILLIAM M. PRATT, president of the Goodell-Pratt Co., Greenfield, Mass., will sail on July 10 for an extended trip to Central Europe. He will visit the company's branch in London and representatives on the continent. Later he contemplates a visit to the company's representatives in the Far East and in South America.

FREDERICK E. MOSKOVICS, of Indianapolis, former president of the Stutz Motor Car Co. of America, has been made president of the Improved Products Corporation, of New York City. Prior to his connection with the Stutz company, Mr. Moskovics was vice-president of the Nordyke & Marmon Company.

MISS KATE GLEASON, of the well-known Gleason family of Rochester, has made a gift of property to the Mechanics Institute, Rochester, N. Y. The gift includes 72 homes and an area of building lots in East Rochester, valued at well over $300,000.

J. M. MCNEAL, direct representative in Europe of the Landis Machine Co., Waynesboro, Pa., manufacturers of threading machinery, sailed June 20 for England after spending a month at the home office in Waynesboro.

W. W. PHILLIPS has been appointed district sales manager of the Eastern district for the Columbia Tool Steel Co., Chicago Heights, Ill. Mr. Philips' headquarters will be in Newark, N. J.

ARTHUR ANDREWS, managing director, Burton, Griffiths & Co., Ltd., London, accompanied by Mrs. Andrews, sailed Wednesday, June 26, for home after a two months' business trip in the United States.

RUSSELL HURLBURT, formerly of Hartford, Conn., has been appointed European manager for the Niles, Bement, Pond Co. with offices at Paris, France.

R. T. STEINDORF, assistant to W. B. Marshall, conveyor sales manager of the Chain Belt Co., Milwaukee, has been transferred to the Cleveland office.

Obituaries

OLIVER AMES, president of the Ames Plow Co., of North Easton, Mass., died at his summer home at North Easton on June 18. He was 64 years of age. In addition to the presidency of the Ames Plow Co., he was owner of the Ames Shovel and Tool Co. of North Easton, vice-president and treasurer of Oliver Ames Sons, Inc., vice-president and director of the Ames Shovel and Tool Co. of Texas, president and director of the First National Bank of Easton, and director in a number of railway and industrial organizations.

SAMUEL W. GLEDHILL, founder of Gledhill & Co., Bridgeport, Conn., dealers in machinery, died on June 18. Mr. Gledhill was born in Cornwall, Conn., and had been in the machinery business for 45 years. The business was taken over some years ago by Arthur Bisgood.

FRANCIS B. COCKBURN, who for more than twenty years had been chief engineer of the Lodge and Shipley Machine Tool Co., of Cincinnati, died on June 21 at his home in Clifton. He was born in Devonshire, England, 64 years ago, and came to this country 35 years ago. He was a member of the A.S.M.E. and of the Cincinnati Engineer's Club.

HORACE LEROY HALL, owner and manager of the Inland Iron Works, Fresno, Calif., died recently at the age of 58 years, following a lengthy illness.

EDGAR C. NEAL, who was treasurer of the Atterbury Motor Car Co. up to 1923, died on June 12 in his Buffalo home. He was 72 years old.

Forthcoming Meetings

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

NATIONAL METAL CONGRESS. To be held in Cleveland September 9 to 13. Simultaneous meetings of the American Welding Society, the Institute of Metals Division of the American Mining & Metallurgical Engineers, the Iron & Steel Division, American Society of Mechanical Engineers, the Iron & Steel Division, A.I.M.E., and the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL METAL EXPOSITION. Eleventh annual, held under the auspices of the American Society for Steel Treating, Cleveland Public Auditorium, Cleveland, Sept. 9-14. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

MACHINE TOOL BUILDERS EXPOSITION. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 826 Provident Bank Bldg., Cincinnati.

MACHINE TOOL CONGRESS. In connection with the exposition of the National Machine Tool Builders' Association, to be held Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio, a national machine tool congress will be conducted under the joint leadership of the S.A.E. and the Machine Shop Practice Division of the A.S.M.E.

The Weekly Price Guide

Rise and Fall of the Market

FIVE price advances, and no declines, represent the changes of the last week in materials listed here. Straits tin rose 1c. per lb. (47½c.); solder, ½c. (32½c.); highest grade babbitt metal, 1c. (62c.); linseed oil, 0.1c. (11.3c.) at New York; slab zinc, 0.1c (6.7c.) at East St. Louis. Steel and iron prices remain steady. There was a falling-off during the week in demand for automotive steel and structurals, the latter mainly on contracts let for bridges and industrial buildings. Semi-finished steel is still scarce.

(*All prices as of June 21, 1929*)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	21.25
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	24.79
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	20.26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20	3.35	3.25	3.90*
No. 12	2.25	3.45	3.30	3.95*
No. 14	2.35	3.55	3.35	4.00*
No. 16	2.45	3.65	3.45	4.10*
Black				
Nos. 18 to 20	2.65@2.75	3.85	3.70	3.80
No. 22	2.80@2.90	4.00	3.85	3.95
No. 24	2.85@2.95	4.05	3.90	4.00
No. 26	2.95@3.05	4.15	4.00	4.10
No. 28	3.10@3.20	4.75	4.15	4.25
Galvanized				
No. 10	2.80@2.90	4.20	4.05	4.05
Nos. 12 to 14	2.90@3.00	4.30	4.15	4.15
No. 16	3.00@3.10	4.40	4.25	4.25
No. 18	3.15@3.25	4.55	4.40	4.40
No. 20	3.30@3.40	4.70	4.60	4.55
No. 22	3.35@3.45	4.75	4.65	4.60
No. 24	3.60@3.70	4.90	4.75	4.75
No. 26	3.75@3.85	5.15	5.00	5.00
No. 28	4.00@4.10	5.40	5.25	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness Decimal Fractions	B.w.g. and	Outside Diameter in Inches ½	¾	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.80
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			47.50
Lead, pigs, E. St. Louis	6.80	New York	8.25
Zinc, slabs, E. St. Louis	6.70	New York	8.25

	New York	Cleveland	Chicago
Antimony, slabs	11.50	13.00	14.25
Copper sheets, base	27.75	27.75	27.75
Copper wire, mill, base	19.87½	19.87½	19.87½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.50@11.00	11.70	10.11
Solder (½ and ½).....	32.25	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			62.00
Commercial genuine, intermediate grade.....			45.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing	75.00*	90.00
Angles, not rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	15.00 @15.50	13.50	13.00 @14.00
Copper, heavy, and wire..	14.75 @15.00	13.00	12.00 @13.00
Copper, light, and bottoms	12.50 @13.00	12.50	11.00 @12.00
Heavy lead.....	5.37½@ 5.62½	6.25	5.00 @ 5.50
Tea lead.....	3.75 @ 4.25	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	8.50 @ 9.00	8.00	8.00 @ 8.50
Brass, heavy, red.....	.....	12.50	12.00 @12.50
Brass, light.....	6.75 @ 7.25	7.50	8.00 @ 8.50
No. 1 yellow rod turnings.	9.00 @ 9.50	9.00	10.00 @10.50
Zinc.....	3.25 @ 3.50	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.113	.11	114
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.2125	.2125	.17
Solder (½ and ½).....	per lb..	.3225	.325	.3275
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.10
Lard cutting oil.....	per gal.	.55	.55	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	31½%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.75@2.85		
Coke, prompt foundry, per net ton...	Connellsville, 3.75@4.50		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.75	
Red lead, dry.....	100 lb. kegs....	New York, 13.75	
Red lead, in oil.....	100 lb. kegs....	New York, 15.25	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, $\frac{7}{16}$-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Dorchester (Boston P. O.) — Schoolhouse Dept., Boston— woodworking machinery for Dorchester high school for Boys on Dunbar Ave., here.

Mass., Nantucket—Nantucket Co., P. O. Box 500—woodworking equipment including electric circular saw, lathing machine, and band saw, all motor driven.

Mass., Quincy (Boston P. O.)—Griffin Co., 144 Rhoda St.— 8 ft. sheet metal brake and squaring shears.

Mass., Waltham (Boston P. O.) — L. W. Dean—resaw outfit for sawing timbers, etc.

Mich., Detroit—Dept. of Purchases & Supplies, 735 Randolph St., J. E. Mills, Comr.— portable d.c. arc welding machine and equipment.

Mich., Detroit — Hennebeck Tool Co., 5930 Commonwealth Ave.—drill press.

Minn., Minneapolis—Bd. of Education, 305 City Hall—will receive bids until July 1, sheet metal working machines and tools including double seamer, turning machine, wiring machine, cornice brake, ring and circle shears, squaring shears, crimping and bending machine, etc.

O., Columbus—Bd. of Purchases, City Hall, H. C. Cain, Secy.—machinery and equipment including lathes, drill presses, boring machines, air compressor, etc. proposed shop in connection with municipal airport.

O., Columbus — General Baking Co., 415 Buckingham St.—two mixing machines, conveyor, 150 ft. long, etc.

Vt., Rutland—P. R. Eaton, 117 West St.— chain power feed electrically operated power glue jointer rip saw, capacity up to 20 ft., also electrically operated moulder, wide range.

Opportunities for Future Business

Calif., Glendale—Vortex Wing Corp., manufacturers of airplanes, is having plans prepared for the construction of a 1 story, 60 x 82 ft. factory. C. J. Weyl, 6536 Sunset Blvd., Los Angeles, Archt.

Calif., Huntington Park—Axelson Machine Co., 6160 South Boyle Ave., is having plans prepared for a 1 story, 120 x 220 ft. addition to factory at Randolph and State Sts. Private plans.

Calif., Torrance — Paramount Portland Cement Co., 2030 Wilshire Blvd., Los Angeles, awarded contract for the construction of a plant including machine shop, etc., here.

Conn., Danbury—A. H. Higson, 87 White St., is receiving bids for a 1 story, 25 x 50 and 55 x 200 ft. garage at White and Granville Ave. Estimated cost $50,000. Sunderland & Watson, 248 Main St., Archts.

Conn., Elmwood (Hartford P. O.) — Wiremold Co., 410 Asylum St., Hartford, awarded contract for a 2 story, 98 x 200 ft. factory here. Estimated cost $175,000. Noted May 2.

Conn., Greenwich—McKeever Chevrolet Co. is having plans prepared for a 1 story, 80 x 200 ft. sales and service station on Post Rd. Estimated cost $75,000. Fletcher-Thompson Inc., 542 Fairfield Ave., Bridgeport, Archt.

Conn., Waterbury—Lux Clock Mfg. Co., 97 Sperry St., will receive bids until July 1 (extended date), for a 4 story, 45 x 150 ft. factory on Johnson St. Estimated cost $150,000. T. M. Freney, 51 Leavenworth St., Archt. Noted June 6.

Ga., Atlanta—H. Richardson, 160 Peachtree St., is having plans prepared for a 3 story, 100 x 120 ft. garage at Spring and Baker Sts. A. Ten Eyck Brosn, 717 Forsyth Bldg., Archt.

Ill., Chicago—Automatic Screw Machine Co., 3419 West 31st St., awarded contract for a 1 story, 42 x 100 ft. addition to factory. Estimated cost $20,000.

Ind., Indianapolis—W. H. Cook, Southport, awarded contract for the construction of a 2 story, 76 x 190 ft. machine shop and garage at 11th and Pennsylvania Ave. here. Estimated cost $50,000.

Ind., Indianapolis—Lincoln Oil Co. awarded contract for the construction of a machine shop and service station at Tibbs Ave. and Washington St. Estimated cost $40,000.

Ind., Lafayette—H. H. Horner, 625 Columbia St., is having plans prepared for the construction of a 130 x 165 ft. garage, etc., on East Main St. Estimated cost $50,000. F. P. Riedel, 825 Lafayette Life Bldg., Archt.

Ind., Kokomo—Western Oil Co., 310 North Meridian St., Indianapolis, will soon award contract for the construction of a machine shop and service station here, also at Brazil. Estimated cost $46,000 each. Bishop-Knowlton & Carson, 312 North Meridian St., Indianapolis, Archts.

Ind., Michigan City—C. A. Dunham Co., 450 East Ohio St., Chicago, awarded contract for a 1 story, 350 x 350 ft. factory for the manufacture of vacuum heating control valves, steam traps, etc., here. Estimated cost $1,000,000.

Ky., Louisville—Reynolds Metals Co., 30th St. and Grand Ave., is having plans prepared for a 2 story, 90 x 100 ft. factory for the manufacture of tin, lead and aluminum foil, etc., on Hale Ave. Estimated cost $60,000. O. P. Ward, Lincoln Bldg., Archt.; also 1 story, 140 x 216 ft. factory for the manufacture of aluminum powder. A. G. Tafel, 140 South Third St., Archt.

Kan., Manhattan—Manhattan Motors Co., c/o H. W. Brewer, 312-314 Houston St., will soon award contract for a 2 story, 100 x 150 ft. garage and service station. Estimated cost $50,000. A. H. Brewer, 250 East Ohio St., Chicago, Ill., Archt.

Mass., Belmont—C. Fulginiti, 101 Hull St., is receiving bids for a 1 story, 40 x 140 ft. repair and service garage on Trapelo Rd. Estimated cost $40,000. Private plans.

Mass., Boston—Schoolhouse Dept., City Hall, will soon receive bids for the construction of a school including shops on Hull St., North End. Estimated cost $250,000. J. M. Gray, 175 High St., Boston, Archt.

Mass., Brookline—W. Greenwood, 8 Emerson St., will build a 1 story, 125 x 150 ft. repair shop and service station at 304-312 Washington St. Private plans. Noted June 20.

Mass., Chelsea (Boston P. O.)—Texas Co., 31 St. James Ave., Boston, awarded contract for a 2 story, 40 x 145 ft. garage, etc., on Marginal Way here. Estimated cost $75,000.

Mass., Fall River — W. E. Fawcett, 1457 Robeson St., is receiving bids for a 1 story repair and service garage on North Main St. Estimated cost $40,000. E. M. Corbett, Bedford St., Archt. Noted June 20.

Mass., Fitchburg—Fitchburg Gas & Electric Co., 655 Main St., awarded contract for a 1 story garage and repair shop. Estimated cost $40,000 to $50,000. Noted June 13.

Mass., Hyde Park (Boston P. O.) — Edison Electric Illuminating Co., 39 Boylston St., Boston, awarded contract for a 1 story, 130 x 155 ft. garage and repair shop on Hyde Park Ave. here. Noted June 20.

Mass., Malden (Boston P. O.)—R. C. Clark, 73 Center St., is having plans prepared for a 1 story, 60 x 190 ft. repair and service garage at 105-107 Center St. Estimated cost $50,000. C. F. Springall, 50 Park St., Archt.

Mass., Newton (Boston P. O.) — Kenmore Realty Co., 15 Deerfield St., Boston, awarded contract for the construction of a 1 story repair and service garage at 714 Beacon St., here. Estimated cost $45,000. Noted Mar. 21.

Mass., Noroton—Fitch Home for Soldiers, will soon award contract for a 2 story, 40 x 140 ft. service station, including carpenter, plumbing and electric shops. Estimated cost $90,000. Payne & Keefe, 231 State St., New London, Archts.

Mass., North Adams—James Hunter Machine Co., will build a 1 story, 70 x 164 ft. addition to erecting shop.

Mass., Waltham (Boston P. O.)—J. W. Greer Co., 119 Windsor St., Cambridge, manufacturers of confectionery and baking machinery, plans a 2 story, 80 x 500 ft. factory here. Architect not selected.

Mass., Wayland—Bd. of Selectman is receiving bids for the construction of a 1 story repair and service garage on Main St. Estimated cost $40,000. J. R. Worcester & Co., 79 Milk St., Boston, Engrs.

Minn., St. Paul—Minnesota Mining & Mfg. Co., E. B. Ober, Pres., Forest and Fauquier Sts., is having plans prepared for a 2 story addition to factory. Estimated cost $150,000. Toltz, King & Day, 1212 Builders Exch. Bldg., Archts.

Mo., Kansas City — **Sheidley Realty Co.** awarded contract for a 8 story garage.

N. J., East Orange—Packard Motor Co. of New York, 198 Central Ave., Newark, will soon receive bids for the construction of a sales and service station here. Estimated cost $500,000. E. C. Epple, 44 Commerce St., Newark, Archt.

N. J., Garwood—United States Aluminum Co., Centre St., awarded contract for a 1 story, 60 x 120 ft. addition to plant. Estimated cost $40,000.

N. J., Jersey City—J. Goldenberg, 80 Woodland St., Englewood, will soon award contract for a 3 story, 150 x 230 ft. garage, etc., at Sip and Summit Aves. Estimated cost $500,000. C. Shilowitz, 26 Journal Sq., Archt.

N. J., Newark — Gilby Wire Co., Riverside Ave., awarded contract for a 1 and 2 story, 90 x 220 ft. machine shop. Estimated cost $50,000.

N. J., Paterson—Watson Flagg Engineering Co., 214 Straight St., is having plans prepared for a 1 story, 75 x 125 ft. machine shop at 843-7 East 25th St. Estimated cost $40,000. Private plans.

N. J., Ridgewood—Morris Motors Inc., c/o R. Jahelka, 15 West 44th St., New York, N. Y., Archt., is receiving bids for a 1 story service station at Essex and Broad Sts., here. Estimated cost $150,000.

N. Y., Brooklyn—Orange Fulton Realty Corp., J. Ellman, Pres., 153 Pierrepont St., is receiving bids for a 9 story garage at Orange and Fulton Sts. Estimated cost to exceed $500,000.

N. Y., Brooklyn—Richard Vom Lehn Jr., 464 East 24th St., plans a 1 story, 100 x 100 ft. garage at 7th St. and East 3rd Ave. Estimated cost $40,000. G. Alexander Jr., 2996 Bedford St., Archt.

N. Y., Harmon—New York Central R.R., 466 Lexington Ave., New York, plans the construction of locomotive and car shops here. Estimated cost $100,000. F. B. Freeman, Ch. Engr.

N. Y., Long Island City — Grand Atlantic Corp., H. S. Hendricks, Pres., 253 Broadway, New York, awarded contract for a garage and service station at Atlantic and Grand Aves., here. Estimated cost $250,000.

N. Y., New York—Agnar Realty Corp., M. D. Strong, Pres., will build a garage, etc., at Broadway and Exterior St. Estimated cost $125,000. Siegel & Levy, 45 W. 57th St., Archts.

N. Y., New York—Art Steel Co., 401 East 23rd St., manufacturers of steel filing cabinets and office furniture, plans the construction of a factory at College Ave. and 145th St. Estimated cost $250,000. Architect not selected.

N. Y., New York—92nd St. Holding Corp., S. Cohn, Pres., 1506 Jerome Ave., will build a 6 story garage and service station at 212 East 92nd St. Estimated cost $400,000. Schaefer & Rutkins, 2408 Grand Concourse, Archts

N. Y., New York—Venitian Contracting Co., J. Philip, Pres., 2 Lafayette St., plans a 2 story garage at Barretts St. and Ryaiva Ave. Estimated cost $40,000. F. Wolfgang, 631 East Tremont Ave.

O., Cleveland—Arcade Garage Co., c/o A. L. Licker, Guarantee Title Bldg., had plans prepared for a 1 story, 80 x 428 ft. sales and service building at 1950 East 105th St. EEstimated cost $150,000. J. F. Steffens, Fidelity Bldg., Archt.

O., Cleveland — Midland Steel Products Co., E. J. Kulas, Pres., West 106th St. and Madison Ave., awarded contract for a 1 story, 96 x 116 ft. factory. Estimated cost $70,000.

Pa., Bridgeville — Selden Co., W. E. Pittsburgh, awarded contract for a two 1 story, 60 x 100 and 40 x 60 ft. factory building here. Estimated cost $50,000.

Tex., Abilene—City, c/o W. A. Biney, Engr., voted $100,000 bonds for the construction of an airport including machine and repair shops, hangars, etc.

Tex., San Antonio — Yellow Cab Co., c/o W. G. Duncan, Pres., will soon award contract for a 1 and 2 story, 140 x 250 ft. garage at Crockett and Nacogdoches Sts. Estimated cost $125,000. Phelps & DeWees, 718 Gunter Bldg., Archt. W. E. Simpson, National Bank of Commerce, is engineer.

B. C., New Westminster — Brunette Lumber Co., plans the construction of a planing mill. Estimated cost $125,000.

Ont., Kitchener — Elshy Furniture Co., plans the construction of a factory on Wilmot St. Estimated cost $100,000.

Ont., Toronto—Neil G. Beggs, 6 Jean St., is having plans prepared for a 4 story garage on Church St. Estimated cost $150,000.

Ont., Walkerville — Motor Products Corp., E. H. Carr, Mgr., is having plans prepared for addition to factory on Walker Rd. Estimated cost $50,000. Smith, Hinchman & Grylls, Marquette Bldg., Detroit, Mich., Archts.

Que., Lachine — Dominion Wire Rope Ltd., F. H. Hopkins, V. Pres., plans addition to plant. Estimated cost $150,000.

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AMERICAN MACHINIST

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McGRAW-HILL PUBLISHING COMPANY, INC., TENTH AVENUE AT 36TH STREET, NEW YORK, N. Y.

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 520 North Michigan Avenue
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
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(Published in San Francisco)
American Machinist—European Edition
(Published in London)

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Annual subscription rate, $5 in North America and South America. Other countries except Europe and British possessions in Eastern Hemisphere, $9 (or 38 shillings). Single copy, 25 cents. McGraw-Hill Publishing Co., Ltd., 6 Bouverie St., London, E. C. 4, England, will serve with the European edition subscribers in Europe and British possessions in Eastern Hemisphere (35 shillings for England and elsewhere in E. H.). For change of address *new* and *old* addresses must be given ten days before the change can take place.

Published weekly. Copyright, 1929, by McGraw-Hill Publishing Company, Inc.

Entered as second-class matter June 23, 1879, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Average number of copies per issue during month of June 18,012

What MACHINERY *does for Man*

Whenever some sentimentalist bemoans the good old days of handicraft, some one connected with some machine industry should give him a copy of this bit of Will Durant's philosophy, taken from an article in the *Century*.

"Through my window comes the sound of a giant machine digging steadily, resolutely, a trench along the street. Deep into the earth sink the iron teeth; a great shovel captures the loosened rock and soil and lifts them into a massive truck; in a trice the truck is filled, and by some magic power the heavy load is drawn away. Here is menial work, but no manual toil, and no slavery; only a proud mechanic guiding the great machine, only a calm driver moving the tons of earth with a touch of his foot and the turn of a wheel. This takes the place of a hundred skilless men, digging wearily, with tools a thousand years old, with patience a thousand years old, never dreaming that their slavery will end. Everywhere the wonder of invention goes, striking the shackles from a hundred men at each step, making mechanical power cheaper than the humblest brawn, compelling men to be only the intellectual factor in the work of life. Slavery comes to an end not because it is unjust, but because it is too wasteful a way of producing the goods of the world."

WILL DURANT, *Century*

A million simple facts like those mentioned in the above quotation are not realized by many people. So coming from a writer like Durant, they appear to be quite new.

Only 100 years ago the industrial machinery industries of the United States were pitifully small, but today they are the second largest group among this country's manufacturers. As these industries are outstanding factors in the world's material progress, all men connected with them have a right to take a proper pride in their contributions to the general welfare. They have the best of reasons to bring before the rest of the world the dignity, the worth-whileness of these industries that have done so much for the balance of humanity.

Not only that, but they have the best of reasons for securing a rich material reward in exchange for what they have done for their fellow men.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

THE JOHNSON FRICTION CLUTCH

As Used In The

MACHINE TOOL INDUSTRY

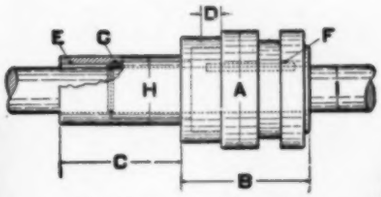
On

DIE CASTING MACHINES

USE

THE **JOHNSON**

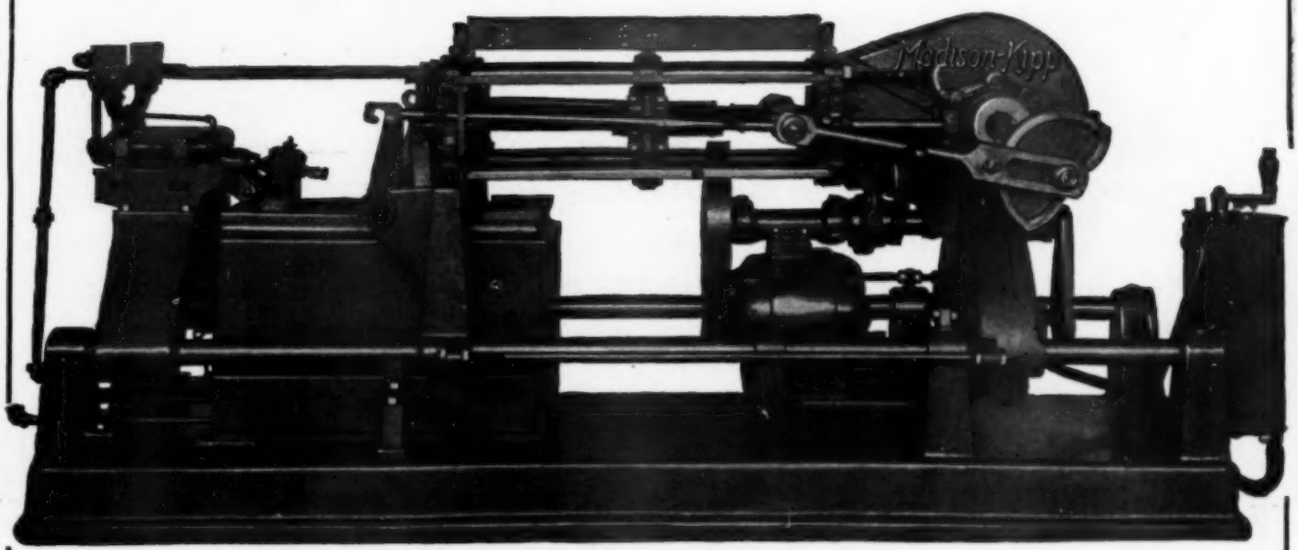
Single Clutch Exterior



Single Cut-Off Coupling Clutch

THE **JOHNSON**

Single Clutch Broken Away



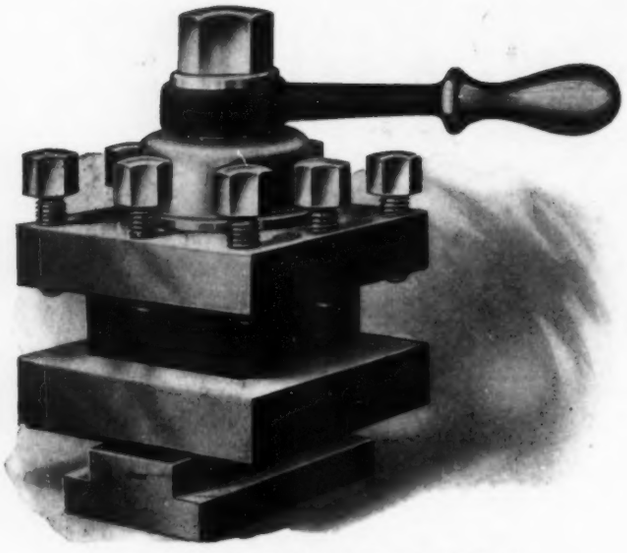
Courtesy: The Madison-Kipp Corp., Madison, Wis.

A No. 5 special single JOHNSON Friction Clutch, transmitting 2 horsepower at 600 R.P.M., is shown above in the cut, above and to the right of the driving motor, the clutch being a one-way cut-off coupling, connecting this driving motor to the power receiving end of the machine. This clutch is operated by hand approximately 2000 times per day.

WRITE FOR CATALOG "BLUE-64"

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

Why the 4 Way?



The Lodge & Shipley 4 Way Tool Block

There are a number of reasons.

First of all—*it saves times!* That, without a doubt, is the most important reason. If it will help you save time it is an investment and as such deserves a place on your lathes.

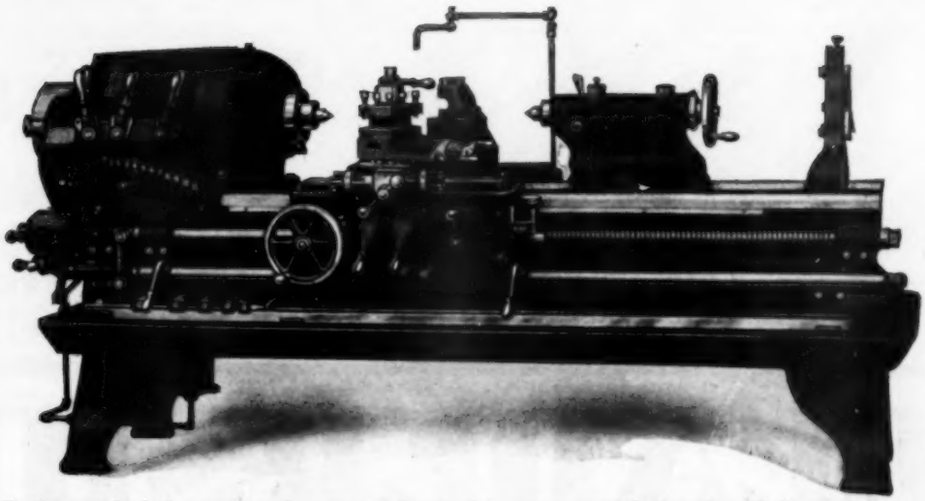
Just think of having a tool block that has four cutting tools ready for instant engagement. Grooving, necking, rounding, knurling, etc., can each be performed in one set-up along with the standard operations.

The block is made entirely of steel and has eight indexing positions. A quarter turn of the binder lever releases the clutch so that the block can be rotated by hand. In manufacturing light pieces with the Four Way Tool Block, instead of changing the work for each operation, the work is set up once. The tool for each successive operation is swung into position as needed until all of the work possible, for the set-up, is done. Just think of the time such an attachment can save!

The Four Way fits in the T-slot on the compound rest and may easily be removed. Another distinct advantage! When the conveniences afforded by the Four Way Tool are taken into consideration is it any wonder that thousands of them are in use today? The man who understands the value of Time is using this attachment. He is getting a maximum production. How about YOU?

The Lodge & Shipley

Cincinnati,



Equipment includes connected, compound and plain rests; multiple length and diameter stops; pan, pump and tubing; four-way and high duty tool blocks.
Made in sizes 12 in. to 30 in.

The Lodge & Shipley Manufacturing Lathe

is a perfect medium between the ordinary engine lathe and the automatic. Where there are occasional lots of parts, too small to warrant the use of an automatic lathe, and when single, one-piece jobs are frequently done, the use of this lathe is ideal.

It not only handles quantity work with a time-saving of 50 to 75 per cent over the engine lathe but it can instantly be converted to a single purpose tool. Ordinary lathe tools are always used and the multiple length and diameter stops when not in use do not interfere with the regular operation of the lathe.

The Four Way Tool Block materially aids this machine in effecting the time-saving mentioned. Eliminating the constant changing of tools is one of the most effective time-saving measures.

Not only does this machine save considerable time but it affords a higher standard of accuracy.

Possibly it could be used to considerable advantage in YOUR shop. Get complete information today.

This booklet tells all about it

Send for it today ***No obligation***

Machine Tool Co.

Ohio

LEADERSHIP has not come over night.
Our growth has been steady, painstaking, venturesome. Repeatedly we have blazed

LEADERSHIP

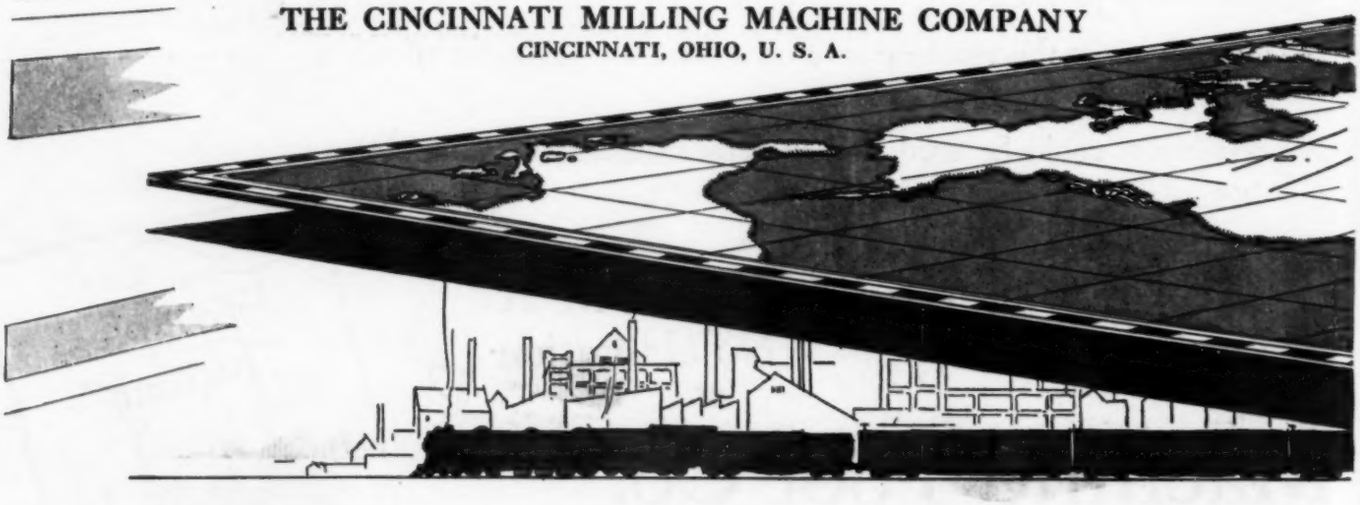
milling machine trails; contributed fundamental improvements in construction and performance.

In your travels in any part of the manufacturing world, you will find enthusiastic users of Cincinnati Millers—both in tool room and in manufacturing shop.

Such *good will,* can only come from a constant contribution of new ideas, new methods, and new designs.

Never in the history of our company have there been greater demands on us for authoritative advice on milling; never have we been better prepared to give this advice and service.

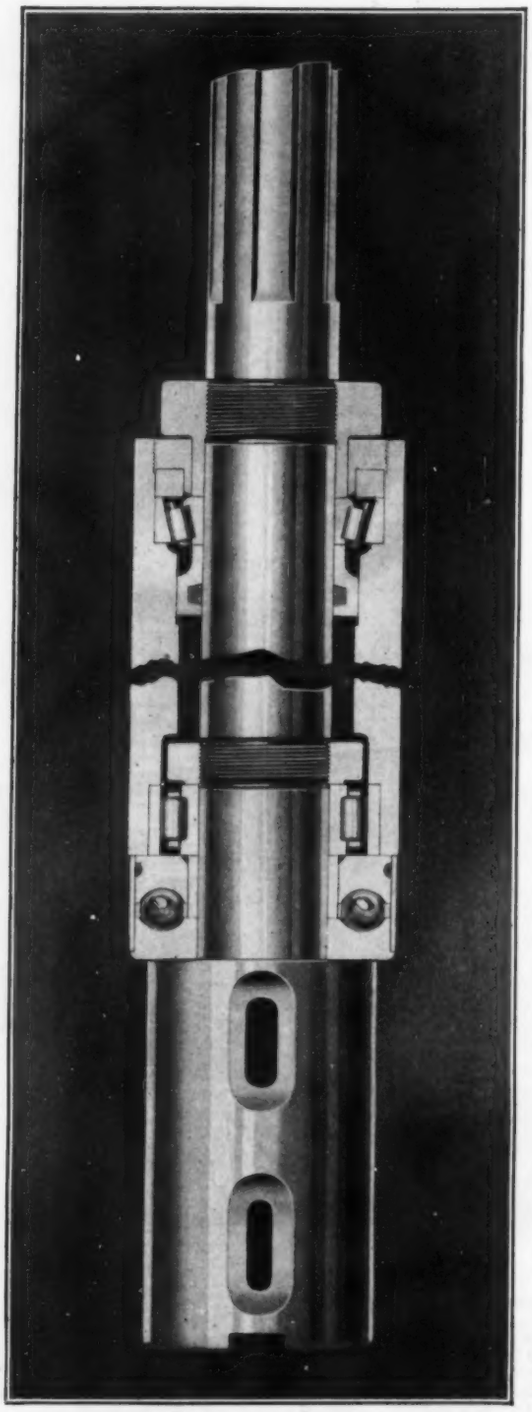
THE CINCINNATI MILLING MACHINE COMPANY
CINCINNATI, OHIO, U. S. A.



CINCINNATI MILLERS

OPPORTUNITY AWAITS CAPABLE YOUNG MEN WHO ARE INTERESTED IN AFFILIATING THEMSELVES WITH OUR ORGANIZATION
CINCINNATI
MAP OF THE WORLD
CINCINNATI MILLERS

For High Production Drilling ...16 SPEEDS AND FEEDS with single purpose simplicity



Spindle bearings for continuous performance

SINGLE purpose simplicity with general-purpose flexibility that, briefly describes the SUPER-SERVICE Production Drill—a machine that is built to go into a production line and perform day in and day out without interruption. Continuous high production and long life are assured by the use of ball and roller bearings, multiple splined heat treated alloy steel shafts and gears, and automatic oiling.

Although a machine of this type may run for days at one speed and one feed, there are times when speed and feed changes are necessary.

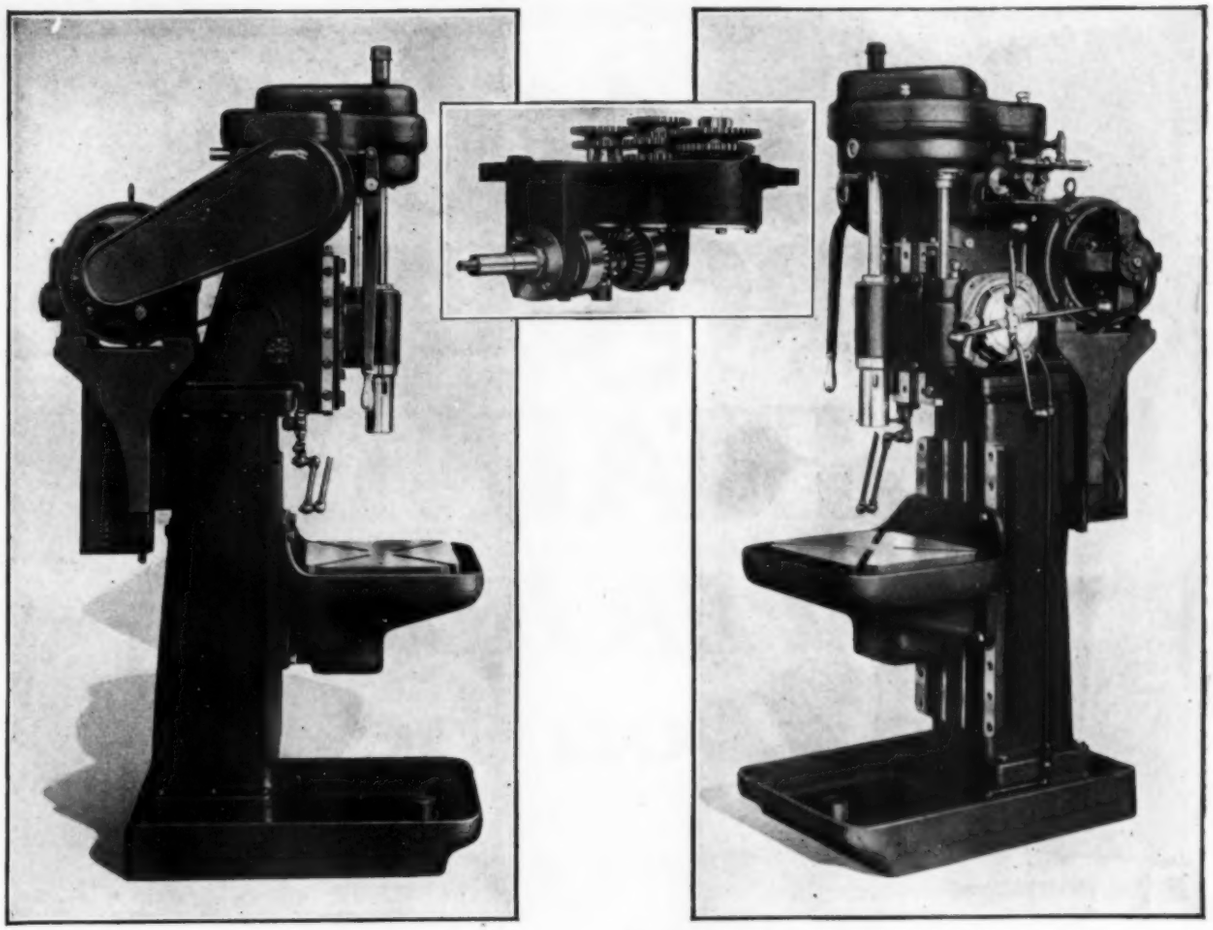
There may be a change in material that will require a reduction of speed and feed, or, it may be found that an increased speed and feed can be advantageously used. Then, there are times when the machine must be transferred quickly to some other job or operation.

The speed of the SUPER-SERVICE Production Drill is readily adjusted to meet requirements by means of four simple cluster gears of two gears each. Interchanging these gears on three vertical shafts permits of sixteen different combinations. Sixteen closely graded speeds, ranging from 263 to 1233 R.P.M. are the result, and yet at every speed there are only three gear contacts between the main driving shaft and the spindle. Rarely is such simplicity of drive encountered even in one speed single purpose drills.

Four similar gears provide sixteen rates of feed in the same way.

The SUPER

THE CINCINNATI BICKFORD



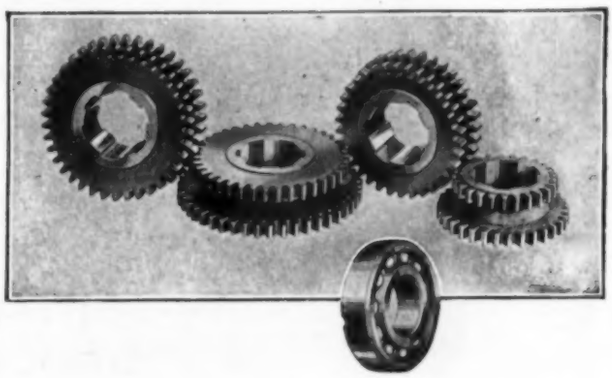
Gearing and clutches are mounted on ball bearings and run in oil

For mass production output, without the risk of obsolescence, the SUPER-SERVICE Production Drill has all the flexibility that is required of a general purpose machine minus all complications. Despite its simplicity any one of the 16 speeds or feeds may be obtained in less than three minutes by transposing the gears in accordance with the speed and feed plate. Gears and shafts are numbered for easy identification.

16 Speeds—263 to 1233 R.P.M.

16 Feeds—.004 to .025 inches per revolution.

Flexibility in securing the right speed and feed, with single purpose simplicity means continuous high production. Mechanically, the SUPER-SERVICE Production Drill is the last word in simplicity. It is built to produce—built to endure.



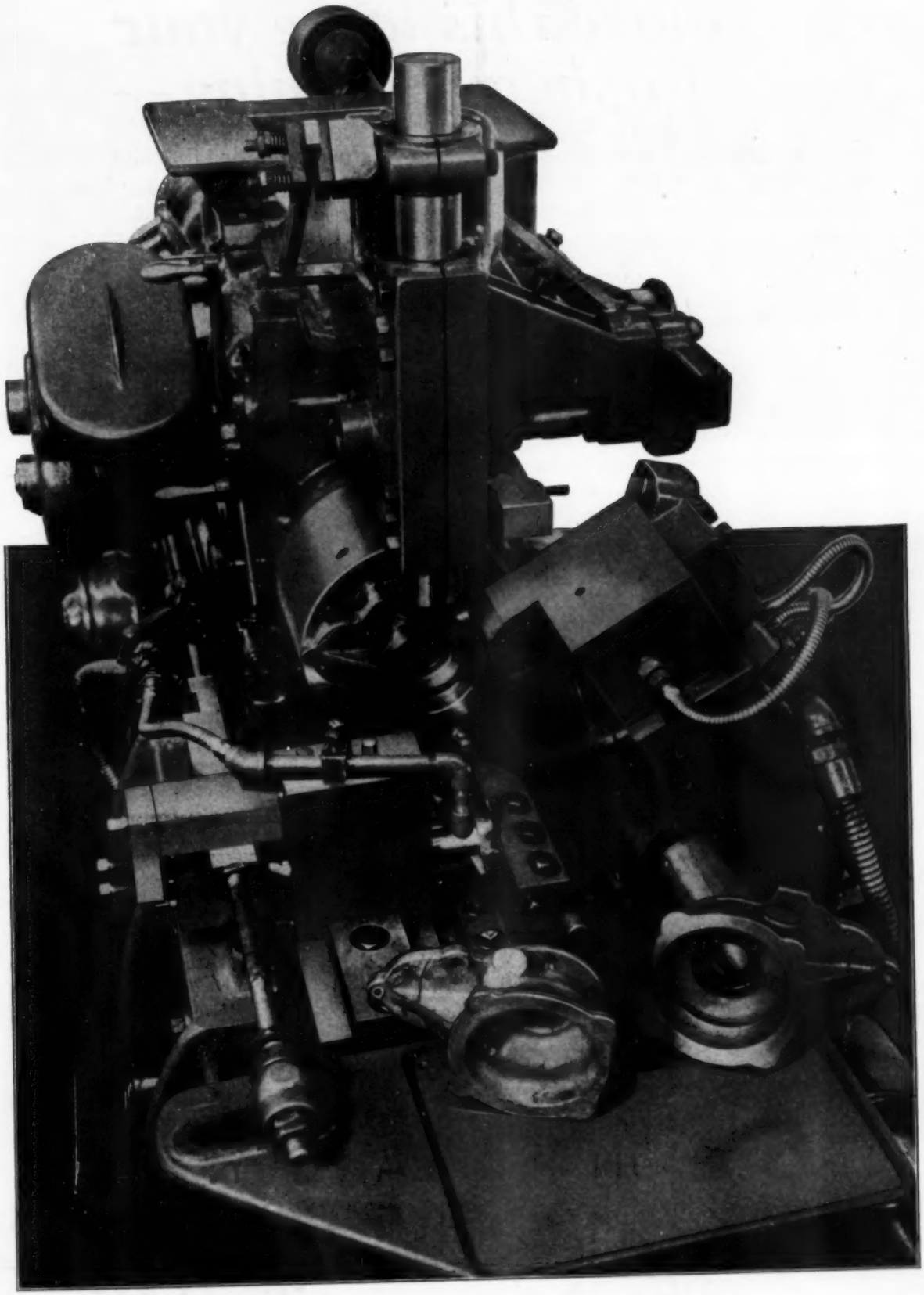
SERVICE *Production Drill*

TOOL COMPANY, OAKLEY CINCINNATI, OHIO

110 TORQUE BALL RETAINERS *PER HOUR* on the FAY AUTOMATIC LATHE

1 man-2 machines

JONES & LAMSON
MACHINE CO.
SPRINGFIELD, VT.



If you know your costs— *you'll make this lathe your choice for heavy turning—*

SLUGGISH equipment is always a handicap; doubly so on heavy duty turning. Yet there are few operations that offer greater opportunities to make a killing.

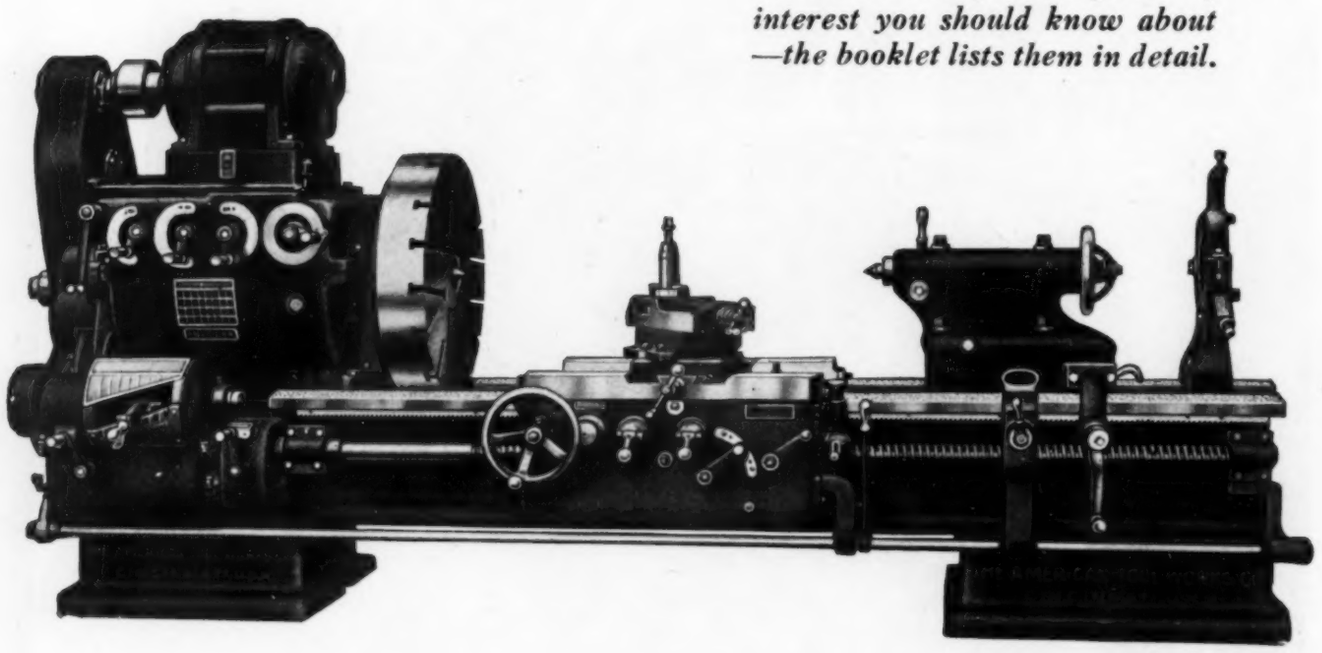
"American Super Productive Lathes are prime favorites on this special class of work. One feature alone—*the internal gear driven face plate*—permits every class of work to be driven up to the full capacity of the most modern cutting tools.

In this improved type design, 12 of the 18 spindle speeds drive through an internal gear face plate. The advantages are obvious. For example, the highest *internal* gear speed on the average lathe is approximately 10 r.p.m., while on the "American" 12 speeds, up to and including 32½ r.p.m. are provided.

This maximum internal gear speed of 32½ r.p.m. provides a cutting speed of approx. 50 ft. on 6 in. dia. stock, which is about three times greater than obtainable on the standard type of heavy duty lathe.

Furthermore, the internal drive design allows greater tooth area in contact, which makes for a smooth, vibrationless drive.

There are many more points of interest you should know about —the booklet lists them in detail.



LATHES—RADIALS—

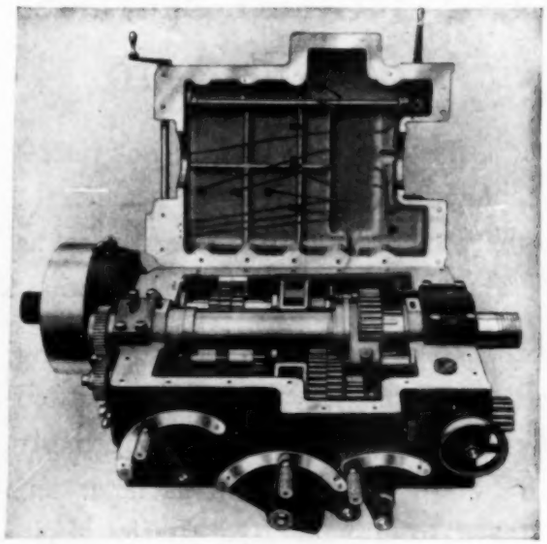
The American Tool Works

Tough work this is, turning down chilled car wheels, but thanks to the internal gear drive, ample power at the most efficient cutting speed is readily available.

AMERICAN

SUPER PRODUCTION HEAVY DUTY LATHE

36 in.—42 in.—48 in.



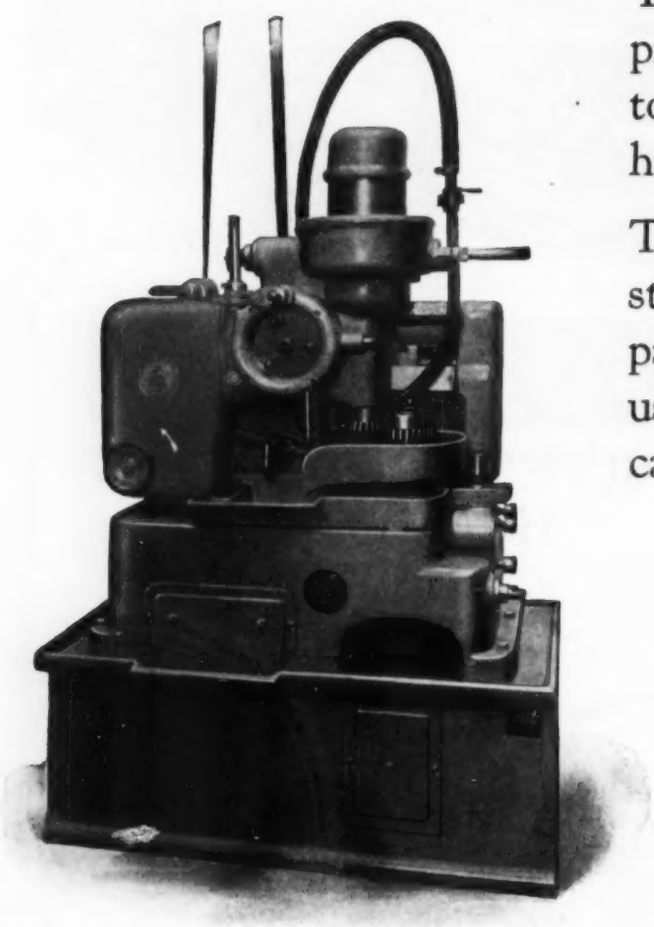
This small pinion meshes in the internal gear face plate and delivers the power to face plate on 12 of the 18 spindle speeds. That means in turning large work, the power is applied at the circumference of the face-plate nearest to the cutting tool—the spindle itself merely serves to steady the work.

SHAPERS

Company, Cincinnati, U.S.A.

Shaping Gears to Industry's Needs

Cutting Taper



The possibilities of the generating principle, particularly as it applies to the Fellows Gear Shaper Cutter, has many profitable advantages.

The cutting of taper serrations on steering knuckles and steering arm parts suggests only one of many uses to which this form of fitting can be advantageously applied.

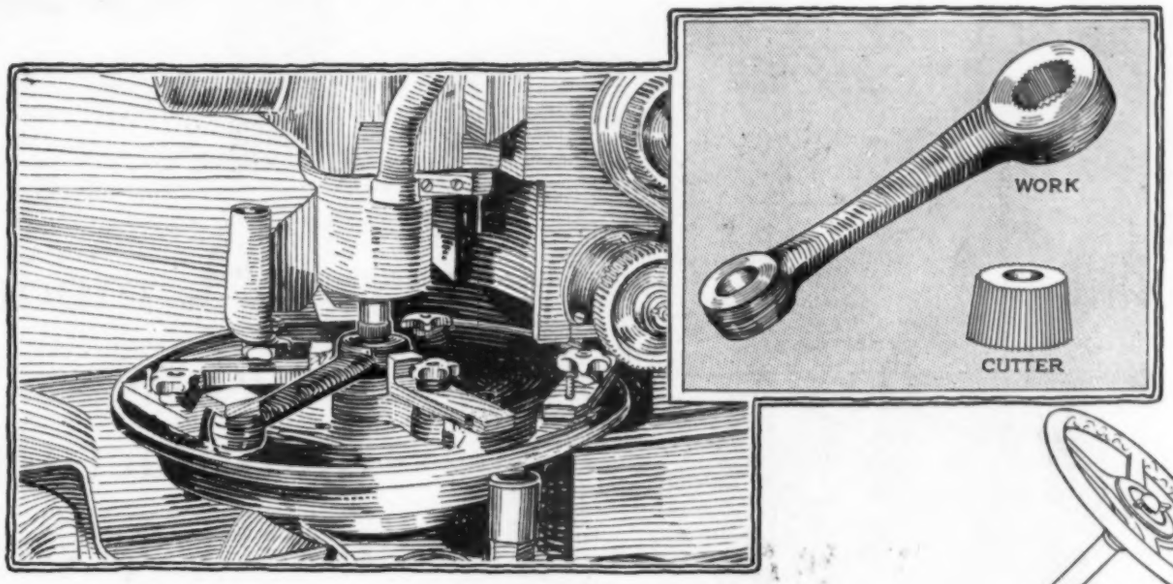
The possibilities of the Gear Shaper Cutter are many and varied. The design of special Gear Shaper Cutters is an engineering problem. Our 30 years of experience in the design and manufacture of Gear Shaper Cutters is at your service.

Taper Serrated Splines for Steering Arm

The High-speed Gear Shaper is not necessarily confined to the cutting of gear teeth, nor to the generating of involute shapes, as the illustration on the opposite page shows.

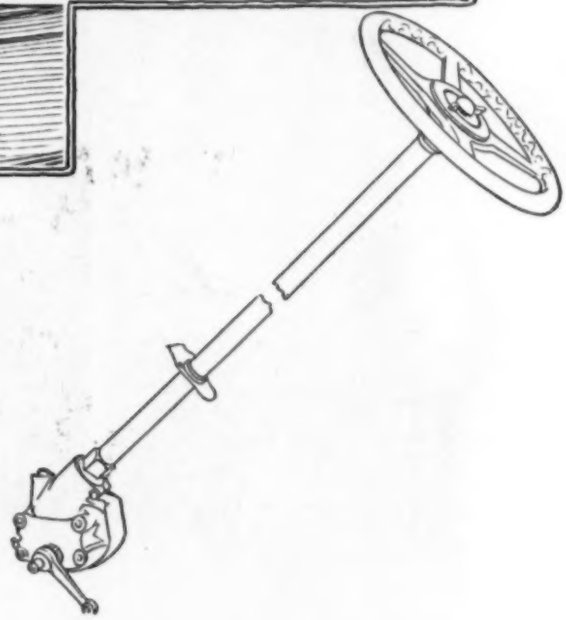
The example here presented is a steering arm for an automobile. The taper serrated hole in the large end of the arm was formerly finished by hot punching. This taper serrated hole is now generated on the High-speed Gear Shaper at a considerable reduction in cost and an improvement in the character of the work.

Serrated Splines



A slightly modified machine is required for this purpose—a tapered raising block is placed between the base and bed of the machine, so that the cutter-spindle is located in an angular position with relation to the work-spindle This does not, however, affect the high production possibilities of the High-speed Gear Shaper.

You will ⌐e interested in our booklet "The Practical Art of Generating." It contains many other interesting applications. *Send for it.*



Serrated Steering Arm for an Automobile Steering Gear

THE FELLOWS GEAR SHAPER COMPANY

Head Office and Works: 78 River St., Springfield, Vt., U. S. A.

Branch Office: 1140 Book Bldg., Detroit, Mich.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, England—Great Britain; Alfred Herbert (India) Ltd., Calcutta and Bombay—India; Alfred Herbert, Ltd., Osaka and Tokio—Japan and China; Alfred Herbert (Australasia), Ltd., Sydney—Australia; Societe Anonyme Alfred Herbert, Paris—France and Spain; Societa Anonima Italiana Alfred Herbert, Milan—Italy; Societe Anonyme Belge, Alfred Herbert, Brussels—Belgium and Holland; Bohm & Bormann, Berlin—Germany, Czecho-Slovakia and Austria; Aktiebolaget A. Bomthrom, Stockholm—Sweden, Finland and Norway; Mathey-Doret & Ferrer, Zurich—Switzerland.

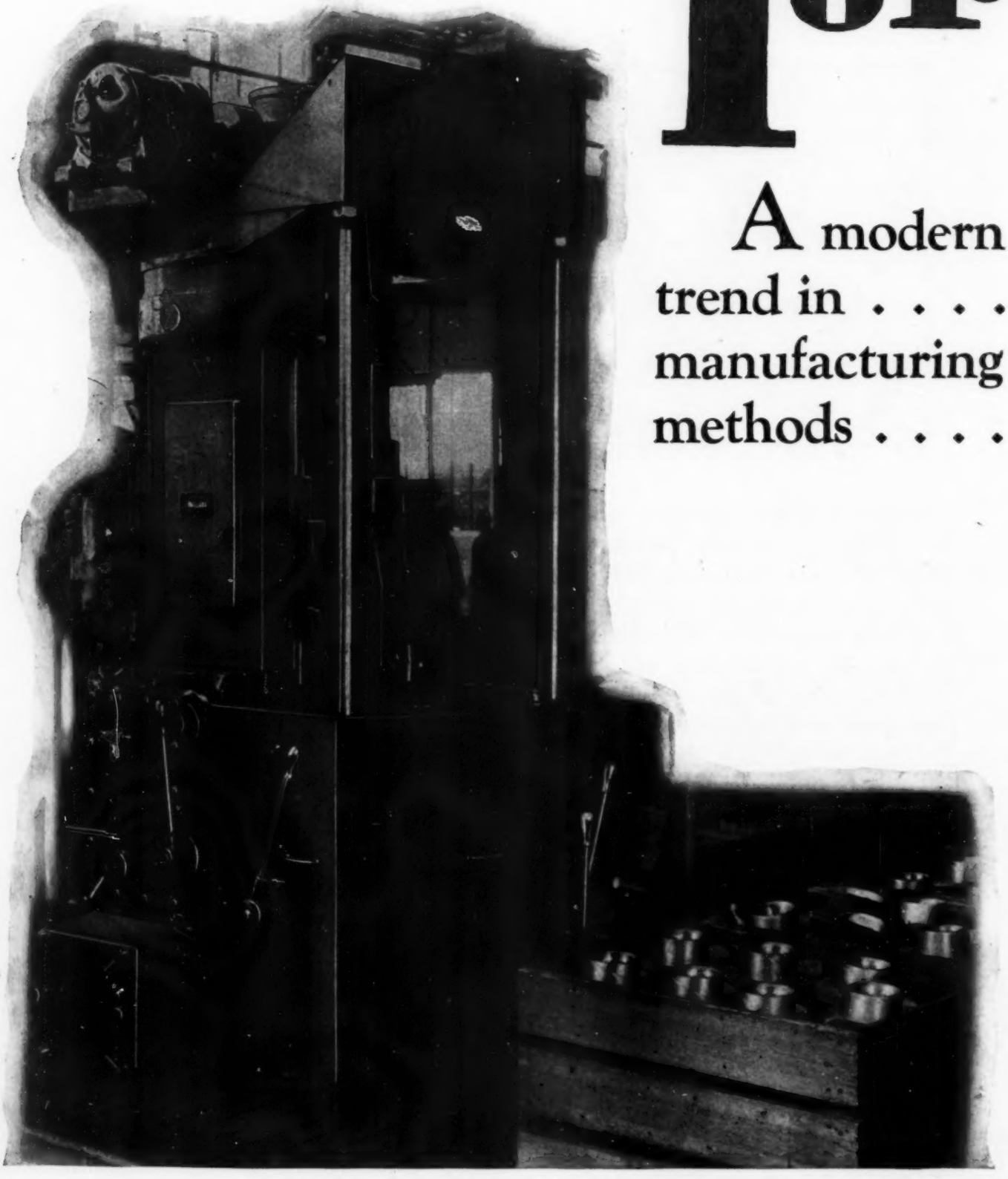
SOUTHERN REPRESENTATIVES—R. S. Armstrong & Bros. Co., Atlanta—Georgia, Montgomery & Crawford, Spartanburg, S. C.—South Carolina & Western North Carolina; Young & Vann Supply Co., Birmingham—Alabama; Oliver H. Van Horn Co., Inc., New Orleans—Louisiana, Mississippi, Western Florida & Eastern Texas; Huey & Philp Hardware Co., Dallas—Western Texas.
PACIFIC COAST REPRESENTATIVES—C. F. Buiotti Machinery Co., San Francisco for Northern California, Reeves & McBride, Los Angeles, for Southern California.

BULLARD

AUTO MATIC

for

A modern trend in . . . . manufacturing methods . . . .



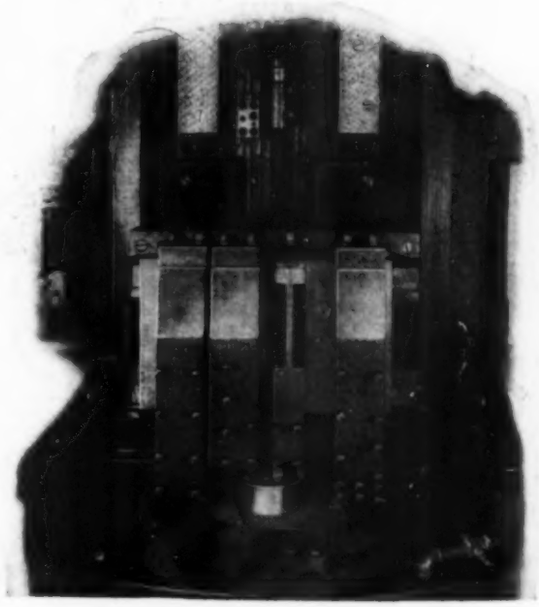
short-run production jobs—

THE manufacturer, today, who associates Bullard performance as applying logically to only long runs of work is missing an assured opportunity to capitalize on the many short runs which can be handled with profit.

More and more manufacturers are taking advantage of the flexibility and quick "set-ups" available by using the Bullard Auto-Matic Vertical Turret Lathe for small and intermediate quantities. In actual operation, its versatility in quick change-over from one job to another, makes it a machine that can be thrown into performance quickly, to suit the different parts to be produced or to meet change in style or model.

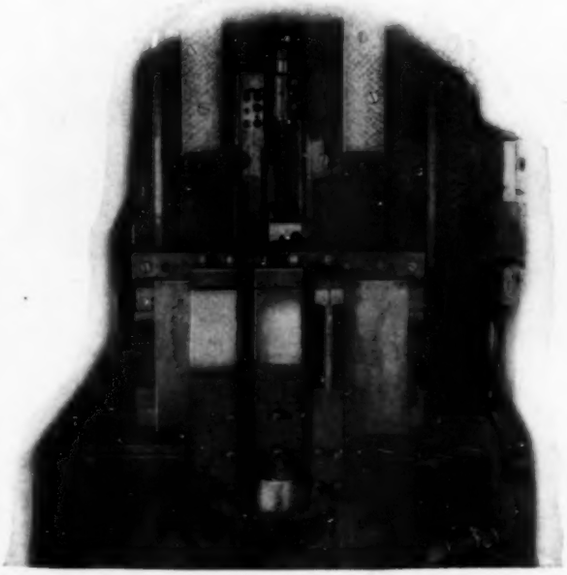
Considering the Bullard for short-run production opens up a new era of economy. Gear blanks, cam blanks, collars, bushings, rings and scores of similar parts can be produced in quantity runs of 40 pieces or less in each lot, with savings over the best previous records averaging 60% of production time saved.

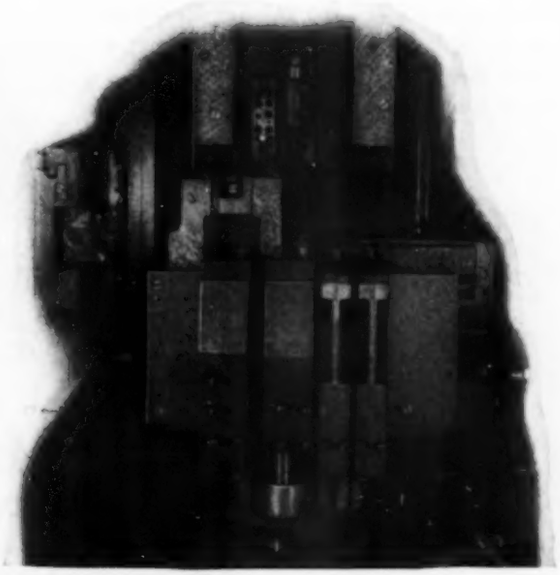
May we send you descriptive bulletin?



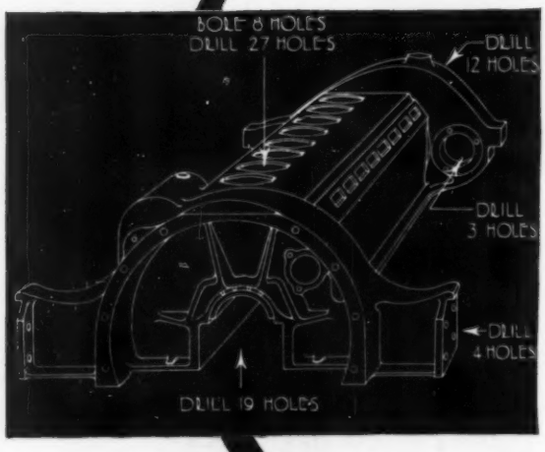
THE BULLARD COMPANY

BRIDGEPORT, CONN.



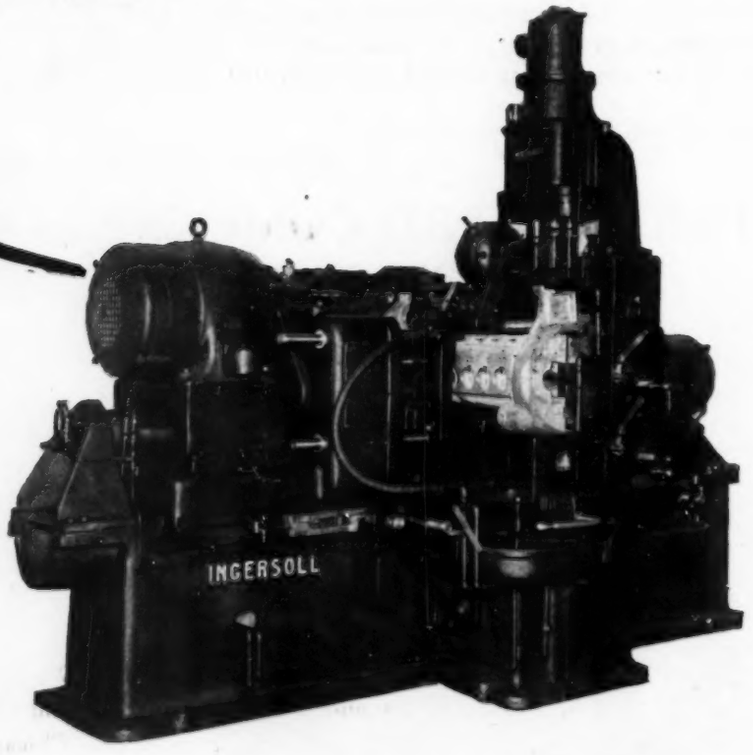


this time it's drilling!



Most Ingersolls are for milling, but we also build many boring, drilling, and tapping machines. This one is a drilling machine which drills sixty-five holes and bores eight in the aluminum crank case shown at the left. Holes are drilled in five faces of the case at one time, and twenty-six cases are produced every hour.

Whatever the operation performed, every Ingersoll is especially designed and built for its job. Most of them are furnished complete with fixtures and cutters, so that we are able to take the entire responsibility for their performance and can guarantee the results.



We would like to study your work with you and go into the possibilities of special Ingersolls. Meanwhile, send for copies of our bulletins which illustrate many of the different types of machines we have built for others.

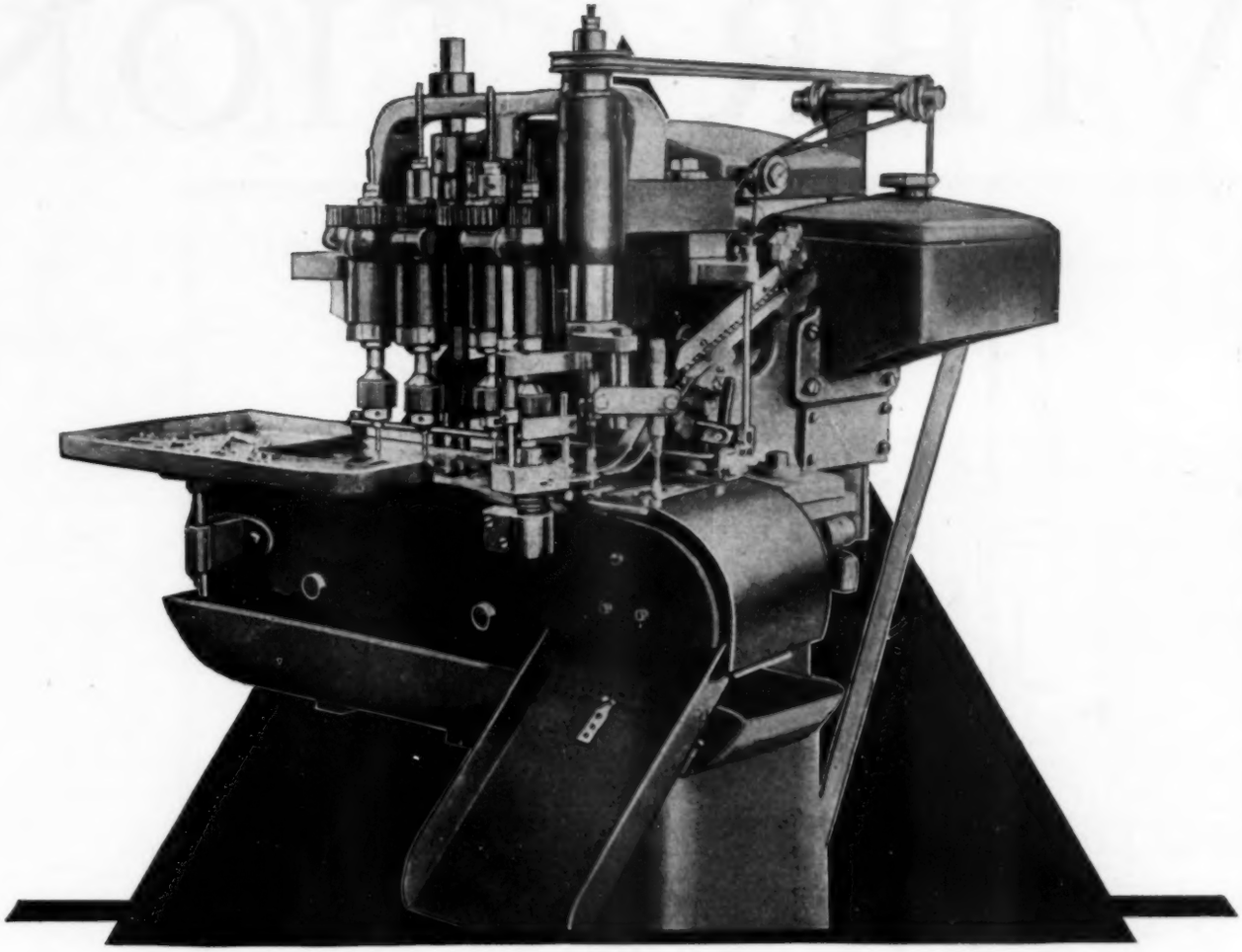
Bulletins—

No. 46—"Ingersoll Equipment for Railroad Shops."
No. 47—"Ingersoll Milling Machines."
No. 48—"The Ingersoll Cutter Grinder."
No. 49—"Ingersoll Milling Cutters."

The Ingersoll Milling Machine Co.

MILLING MACHINES AND SPECIAL MACHINE TOOLS

Rockford, Illinois, U.S.A.



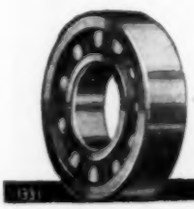
Sensitive machines require accurate bearings

SPINDLES in this automatic high speed tapping machine run true and free, yet have a high degree of rigidity, for they are mounted on New Departure Ball Bearings. The nickel-steel worm is also equipped with New Departures to insure a proper and permanent mesh with its bronze gear.

This machine not only automatically taps small metal parts but automatically starts screws into the tapped holes and counts the pieces as they are ejected.

The Globe Mfg. Company, its maker, finds that New Departures give the machine a high degree of sensitiveness as well as extreme durability and operating economy. Machine tool builders and users will be interested in our practical booklet, "More and Better Production at Less Cost."

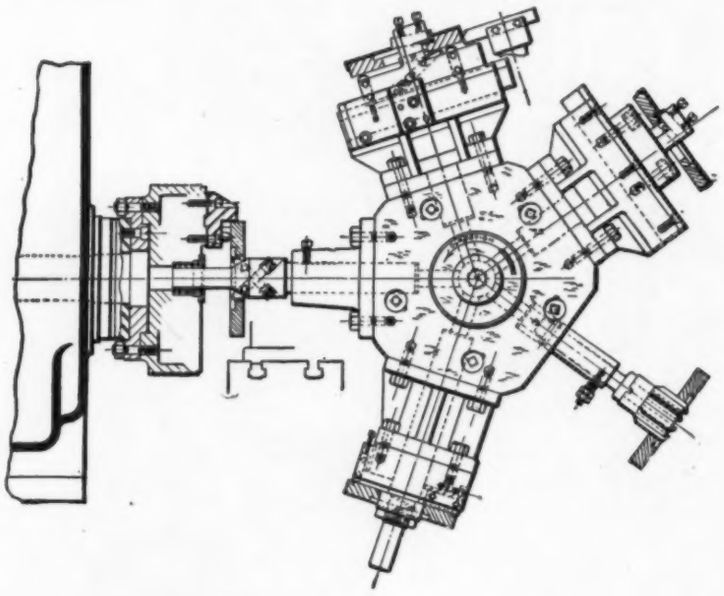
The New Departure Manufacturing Company, Main Offices and Works, Bristol, Connecticut; Sales and Engineering Offices, Detroit, Chicago and San Francisco.

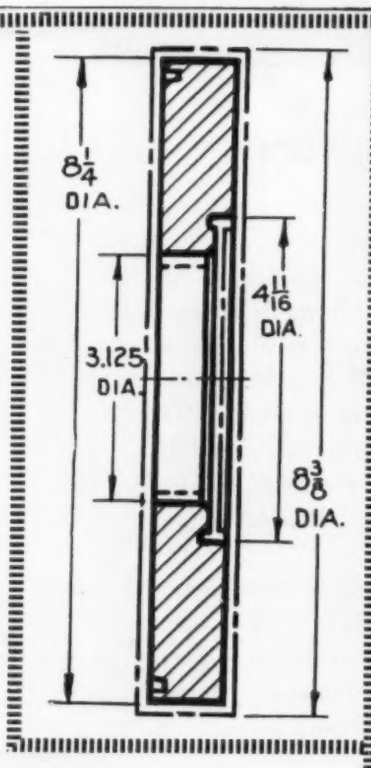


NEW DEPARTURE

BALL BEARINGS

VIBRATION



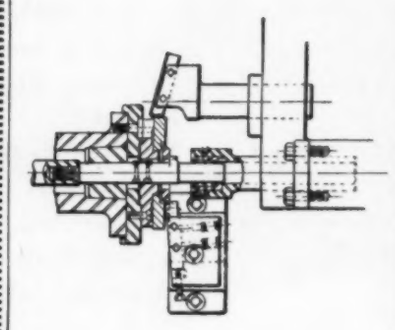


FIRST HOLDING

Machining Time—2.6 Minutes
Production per Machine
20 Flywheels per hour

SECOND HOLDING

Machining Time—2.6 Minutes
Production per Machine
20 Flywheels per hour



P & J

DAMPENERS

No problem when scheduled on a set-up like this—

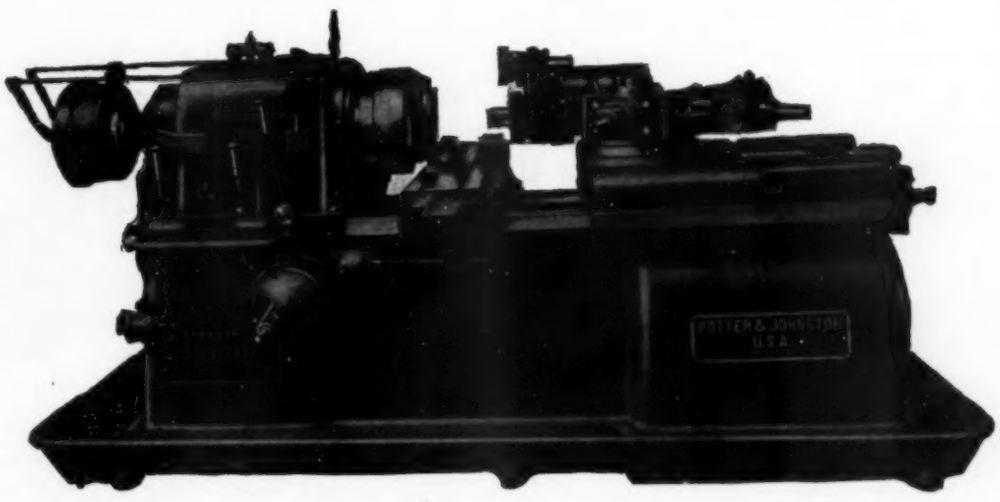
Starting from 1914 the average price of automobiles has steadily declined. The 1928 automobile dollar buys $1.07 whereas it buys only 61 cents in the general commodity field. Unquestionably the automobile dollar will buy even more in 1929 because each price reduction taps new levels of purchasing power.

And as the automobile executive well knows, price reductions start from production economies—methods have to be right, right at the start.

This set-up shows how one big manufacturer revised his vibration dampener set-up. Four P & J's, manned by one operator turn out 40 completed dampeners per hour. Both sides are finished—each side being completed in 2.6 minutes flat.

Five turret faces holding multiple tools, two cross-slide positions, with all cycles perfectly timed, offer machining resources unapproached by any similar equipment. And the savings of continuous high output are further heightened by spreading the direct labor charge (in most cases one operator) over a number of units. Furthermore, changes in yearly design never make it necessary to scrap P & J's—they fit into every sort of production scheme.

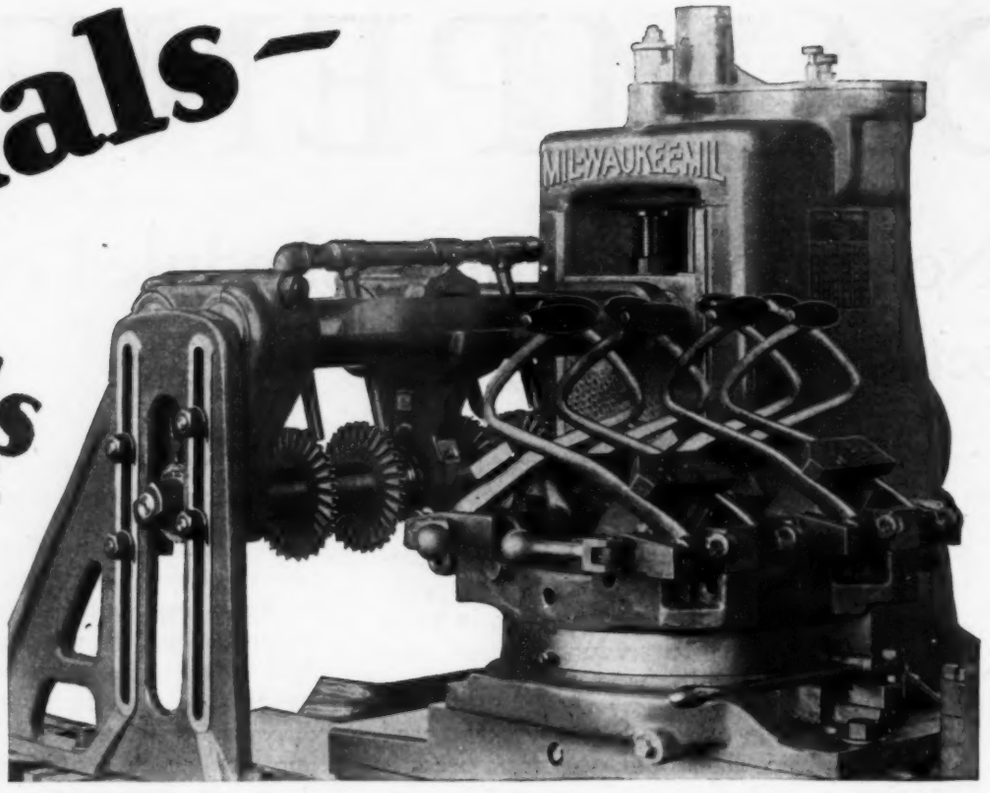
Our engineers have acquired a highly developed technic in this special field—knowledge that is yours for the asking.



POTTER & JOHNSTON MACHINE COMPANY
PAWTUCKET RHODE ISLAND, U. S. A.

AUTOMATICS

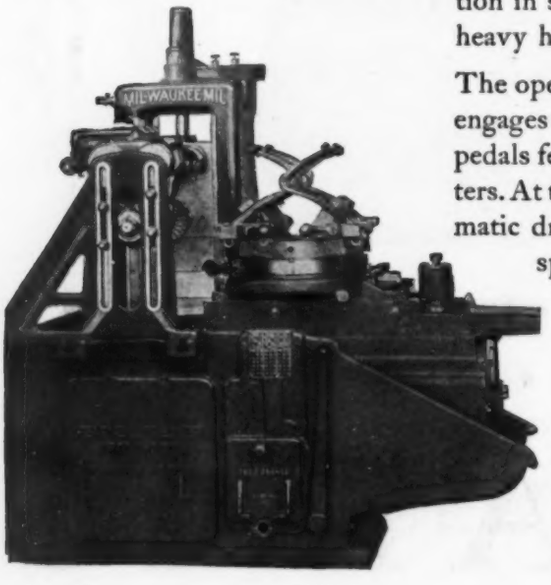
Pedals—Pedals—Pedals!



Ten Seconds Apiece!

ANOTHER manufacturer's production was boosted to a highly profitable figure—this time with a 1404 Mil-waukee-Mil Simplex. Think of it—a clutch pedal every ten seconds. That's an output of 2880 per eight hour day—a production increase of 500%.

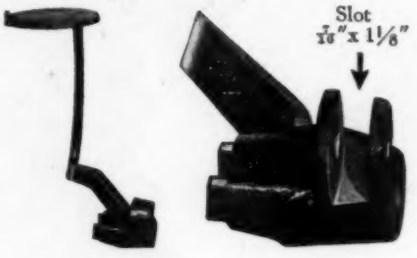
The job was to mill $^{7}/_{16}$"x 1-$^{1}/_{8}$" slots in tough steel forgings. The operator loads and unloads—that's about all there is to it.



A 17" diameter index table is mounted upon the reciprocating table and carries a hand indexing fixture holding 8 pieces. The pedals are mounted on studs and securely held in position in sets of four each, by two heavy hand clamps.

The operator loads the fixture—engages the starting lever, and four pedals feed straight into the cutters. At the end of the cut the automatic drum cam control device speeds up the return to the indexing point. Just index the fixture half way around—touch the starting lever and four more pedals are on their way to the cutters. This time the operator is unloading and loading at the other side of the fixture. From then on he has all that he can do—this cycle is completed 90 times every hour.

No milling machine of the past decade has offered so many new



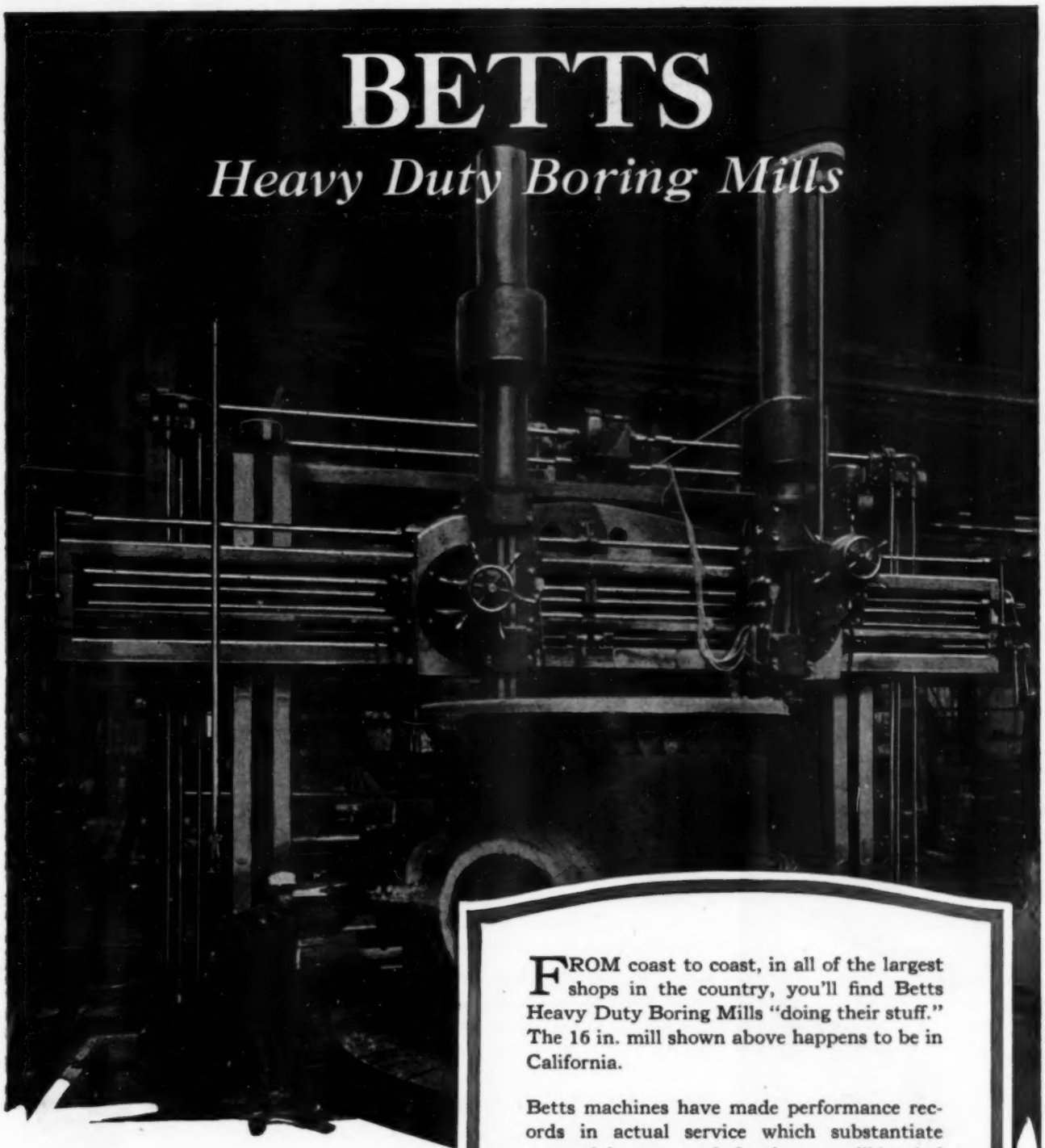
and basic developments as the new Mil-waukee-Mil. It stands out sharply as an example of machine design in which the benefits and economies of unit construction are awarded to the user.

A list of Mil-waukee-Mil users reads like "Who's Who in Industry."

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WIS., U. S. A.

BETTS

Heavy Duty Boring Mills



FROM coast to coast, in all of the largest shops in the country, you'll find Betts Heavy Duty Boring Mills "doing their stuff." The 16 in. mill shown above happens to be in California.

Betts machines have made performance records in actual service which substantiate every claim ever made for them—we'll be glad to furnish some of them if you are interested.

We solicit your inquiry.

These mills are built in sizes from 100 in. up to 32 ft. and we can build them larger if you need them.

BETTS-COLBURN-NEWTON-HILLES & JONES-MODERN

CONSOLIDATED

CONSOLIDATED MACHINE TOOL CORPORATION *of* AMERICA, Rochester, N. Y.

103

The worm turns on TIMKENS

Speed reduction and friction elimination go hand in hand. Strength with compactness and simplicity is also achieved by Boston Gears utilizing the radial-thrust capacity of Timken Bearings.

The Boston Gear Works, Norfolk Downs, Mass., is another of the many heavy-duty machine builders who pass to their customers the advantages of Timken Bearings.

Power savings. Lubrication economy. Full-time operation. Negligible maintenance. Endurance. Timken Bearings have all of these. Timken-equipped machines have them too because of the way Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken electric steel handle all loads, all ways and at all times.

Buy "Timken-Equipped" for greater economy. Immediate replacement with "Timken-Equipped" is the profitable procedure of the day!

THE TIMKEN ROLLER BEARING CO.
C A N T O N , O H I O

TIMKEN *Tapered Roller* **BEARINGS**

UNION
Cutting Service
is
Unsurpassed
Covering

MILLING
DRILLING
REAMING
HOBBING
THREADING

UNION

Ground Twist Drills

Obtainable promptly from stock in all standard styles and sizes.

Ground on diameter to commercial limits from No. 60 up—both Carbon and High Speed Steel.

Union Ground Twist Drills are production tested and performance proved.

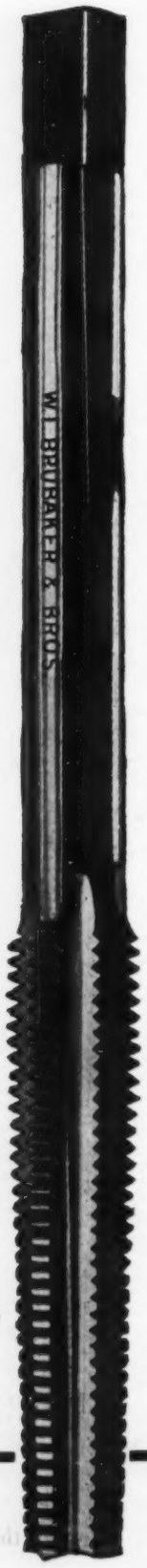
Standardize on them!

UNION
Twist Drill Co.

Athol, Mass., U. S. A.

121 Second St., San Francisco
Chicago, 11 So. Clinton St. New York, 62 Reade St.
Mansfield, Mass. Derby Line, Vt.
Rock Island, Quebec

Representatives Throughout the World



The Test of a Tap

Habitual uniformity in pitch, lead and diameter; true temper—no rapid wear in one tap and no brittleness in another; extra tapped holes between grinds—all result in long, satisfactory service, and combine to form the true test of a tap.

Brubaker Nut Taps have passed all these tests, and are recognized by leaders to be superior products of their type.

We gage this recognition by re-orders and steadily increasing new users.

Brubaker Nut Taps, and all other Brubaker Small Tools are detailed in our Catalog.

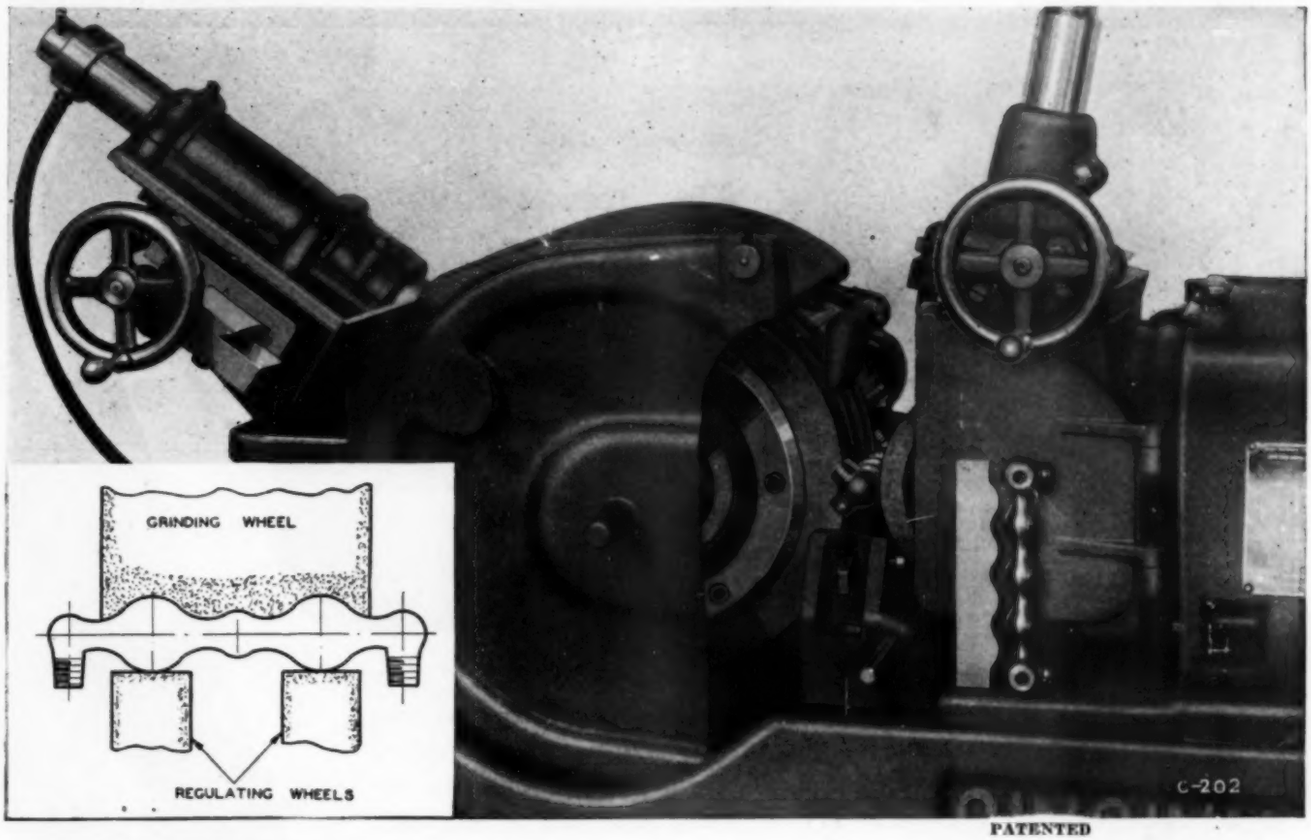
BRUBAKER NUT TAPS

W.L. BRUBAKER & BROS. Co

FACTORY, MILLERSBURG, PA.

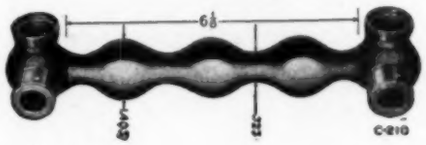
***Sales Office*: 50 Church St., New York**

Taps Dies Reamers End Mills Stay Bolt Taps



PATENTED

ECONOMICALLY GRINDING FAUCET PIPES ON THE CINCINNATI CENTERLESS



Part Name—Faucet Pipe
Material—Brass
Operation—Finish Up
Stock Removal—.100 in.
Finish—Good
Number of Cuts—1
Method of Grinding—Infeed
Production per hour—150
Grinding Wheel—
Grit and Grade—36S-K-B4 Carborundum Vitrified Wheel. Maker—Carborundum Company
Machine—No. 2 Cincinnati Centerless Grinder

The substantial economies which Cincinnati Centerless Grinders are effecting on many heretofore impractical operations are conclusively demonstrated by this job. This faucet pipe is ground by the infeed method to a predetermined profile. For quickly and conveniently placing the work between the grinding and regulating wheels, a cam arrangement which increases the spread between the wheels is used. The method of grinding is illustrated in the inserted sketch above.

Truing of the grinding wheel is accomplished by a diamond tool. The radial movement of the diamond relative to the axis of the grinding wheel is controlled by a cam which has the profile of the work to be ground. An auxiliary boosting lever for the grinding wheel profile attachment is used to move the follower over the steep angles of the cam.

Formerly slow hand polishing methods were employed to finish these castings. Now, through the use of the Cincinnati Centerless Grinder, production has been substantially increased.

You may have similar problems that can be profitably handled by the *Centerless method.*

DEPENDABLE COUNSEL ON GRINDING

CINCINNATI GRINDERS

THEY'RE BLENDED

Uniform polishing abrasives can be produced only with ores of uniform chemical composition. By blending alone can the necessary chemical structure be attained.

Every carload of ore used in making Alundum polishing grain is chemically analyzed and then blended with others before fusing.

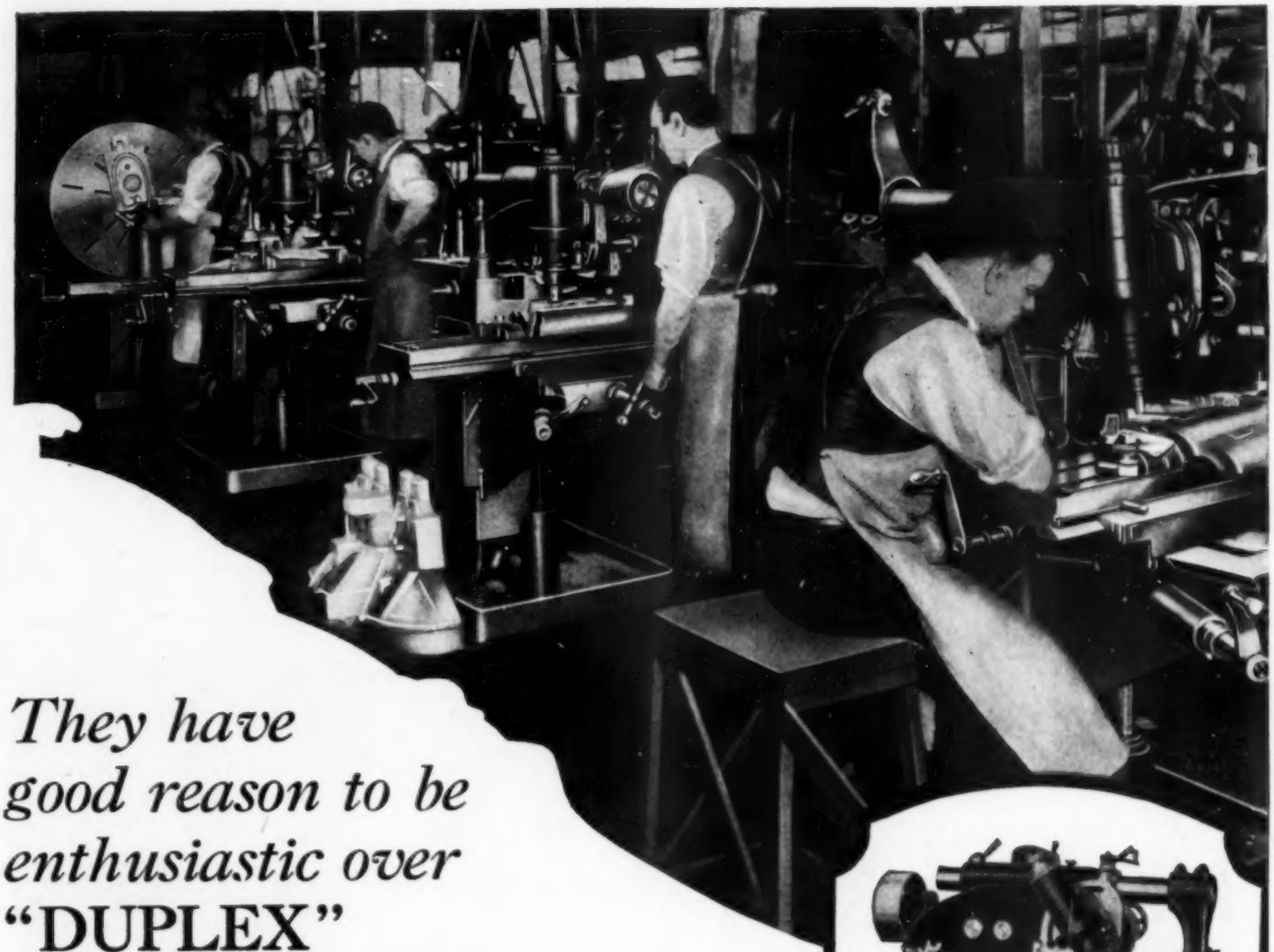
This is only one of the 15 tests made to insure uniformity of size, shape, structure, hardness and cutting action.

NORTON COMPANY
Worcester, Mass.

New York, Chicago, Detroit, Philadelphia, Pittsburgh, Cleveland, Syracuse, Hartford
Norton Company of Canada, Ltd., Hamilton, Ontario

W-248

NORTON
POLISHING ABRASIVES



They have good reason to be enthusiastic over "DUPLEX" *flexibility here*

The City Pattern Works, Detroit, have long been one of the automotive industry's right arms when it came to patterns. They continue in high esteem because of their technical knowledge as well as their ability to put through new model patterns with utmost speed and fair prices. This latter problem is greatly simplified by their battery of eight Van Norman DUPLEXES.

Each Van Norman DUPLEX combines a Vertical, a Horizontal and an Angle Miller in one sturdy, compact machine, and is particularly valuable in pattern shops because most of the work can be handled at one setting of the work.

It is an extremely versatile Miller—for Tool Room and General Utility purposes.

Write for details.

What Van Norman "Duplex" Millers are saving in other plants—they will also do in yours.

Van Norman
"DUPLEX" Millers

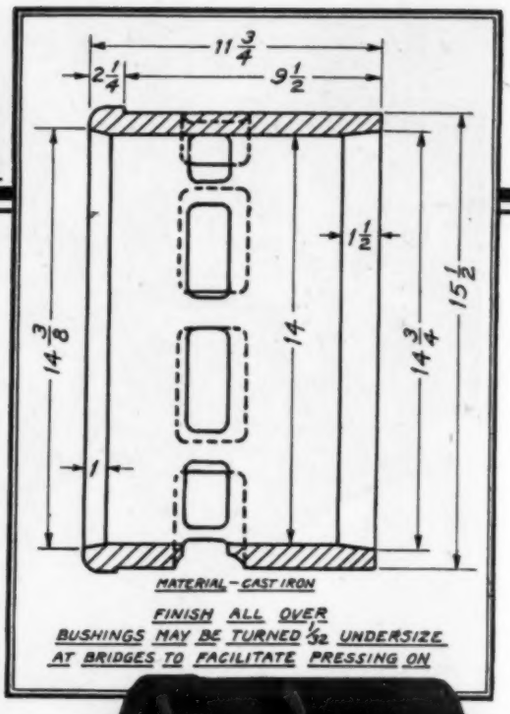
VAN NORMAN
MACHINE TOOL COMPANY
160-200 Wilbraham Street
Springfield, Mass., U. S. A.

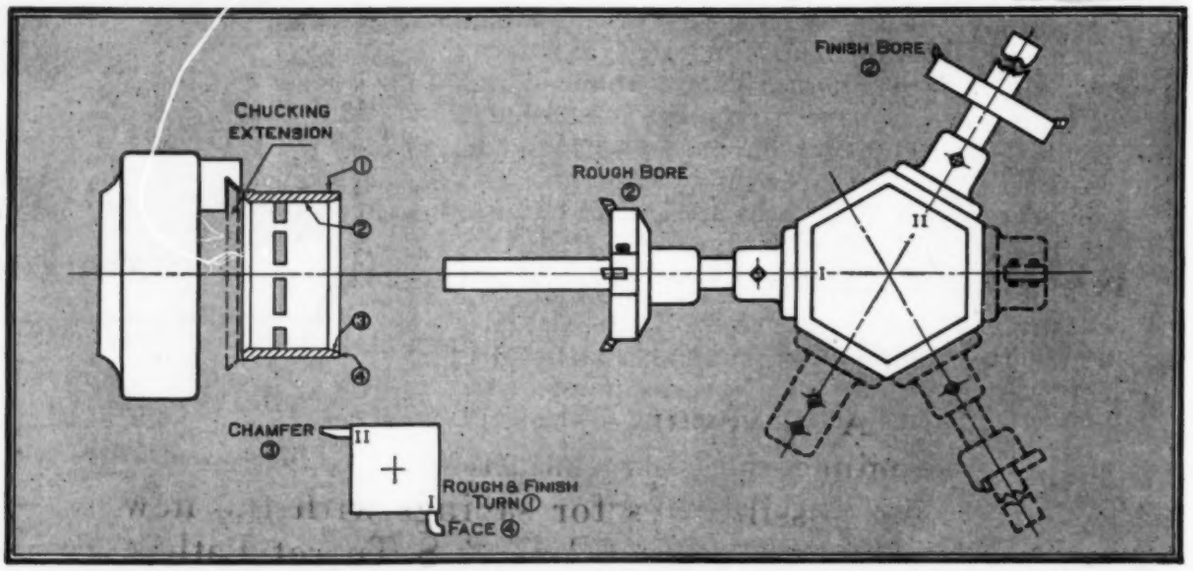
47 hours saved

THE ——— ——— R. R., ———, Ohio, formerly took 60 hrs. for a lot of 20 Steam Chest Bushings.

After installing a Warner & Swasey 4-A Turret Lathe, they produced a lot in 13 hrs.—a 47-hr. saving over the old method.

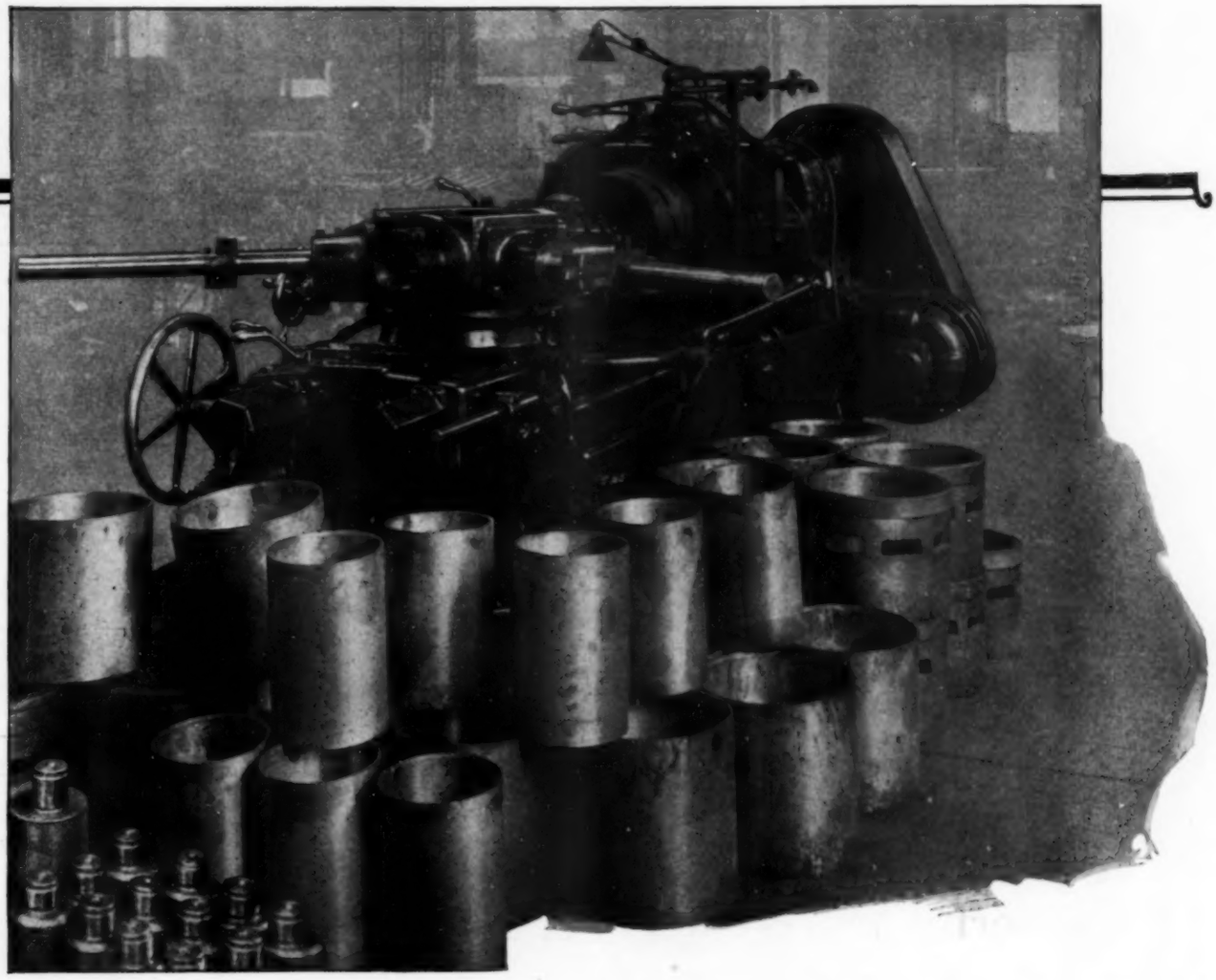
This saving was made possible by combining the turning and boring cuts. The W. & S. being a more powerful machine, it was able to pull these cuts at increased feed.





The W & S Tooling Layout for Steam Chest Bushing

The Warner & Swasey Company
Cleveland, Ohio, U. S. A.



Similar savings were made on other parts, some of which are shown above, grouped around the machine. These parts consisted of Air Pump Cylinder Bushings, Piston Valve Followers, Bull Rings, Knuckle, Cross Head, Articulating and Crank Pins, and were made in lots of from 4 to 24 pieces.

A survey in your shop by one of our engineering representatives will determine the possibilities for savings with the new and more powerful W & S Turret Lathes.

Branches

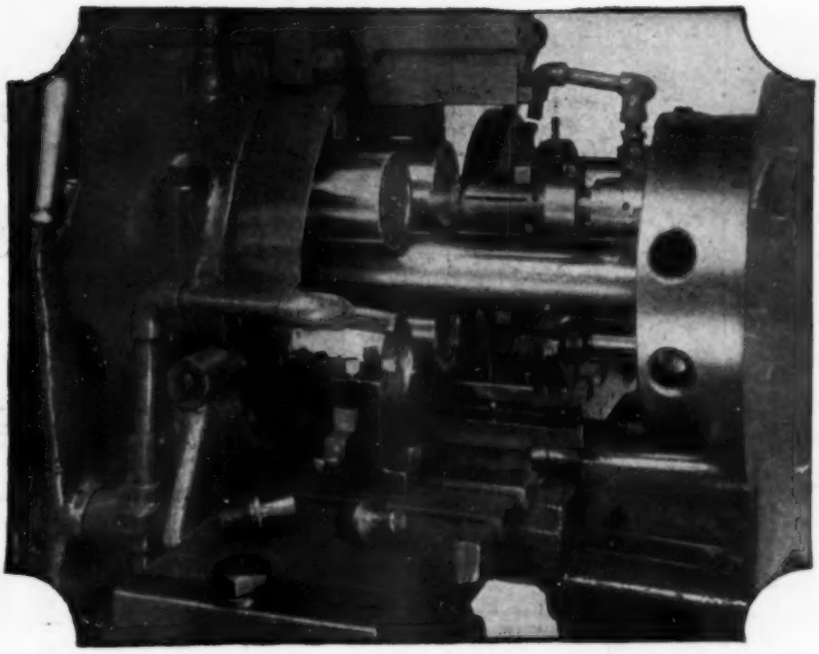
Boston: Chamber of Commerce Building
Buffalo: Iroquois Building
Chicago: 618-622 Washington Boulevard
Dallas: 5832 Victor Street
Dayton: 518 Mutual Home Building
Detroit: 5928 Second Boulevard
Indianapolis: 38 North Bolton Street
Los Angeles: 1118 Santa Fe Avenue
The Warner & Swasey Co., of Calif.
Milwaukee: 1143 Wells Building
New York: Singer Building
Pittsburgh: Chamber of Commerce Building
Philadelphia: 5143 Spruce Street
St. Louis: 108 North Kingshighway
Syracuse: 108 Grant Avenue

For 35 years Acme White has been the standard buffing composition for producing the highest lustre on nickel, copper, brass and other metals. It is the one lime composition that never varies in quality nor in performance. It is the final magic touch that has produced public acceptance for thousands of nationally known plated products.

HANSON MUNNING

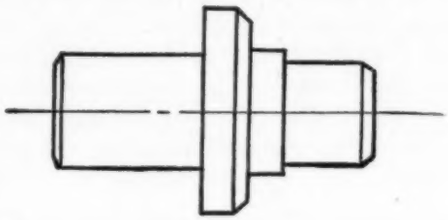
Leading manufacturers of polishing and plating equipment and supplies

Hanson-Van Winkle-Munning Co., Matawan, N. J., and Chicago



Cleveland Solves this Problem for Far Away Czechoslovakia

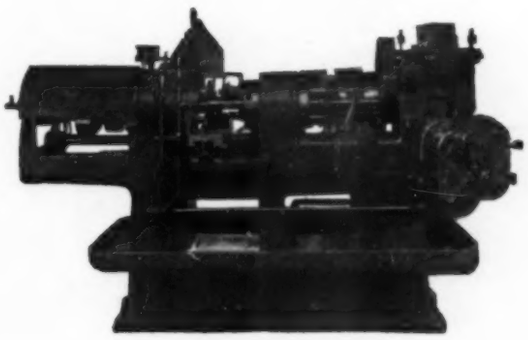
THIS 3" Model M, 4-Spindle, Cleveland Automatic Chucking Machine is used by a manufacturing concern in Prague, Czechoslovakia, for first and second operations on a small alloy steel forging.



The forgings are hand fed into a conveyor, carried on an accelerated spindle in the upper front position and carried by it to the chucks, which are of the collet type, air operated.

Movement of the conveyor is independent of the tool feed and permits the piece to be chucked while the cutting tools are at work. This independence of spindle action, variously adapted on different jobs, is one feature that makes Cleveland specialization such a dependable resource in two hemispheres.

Cleveland Engineers are always at your service to recommend specialized equipment for your production problems.



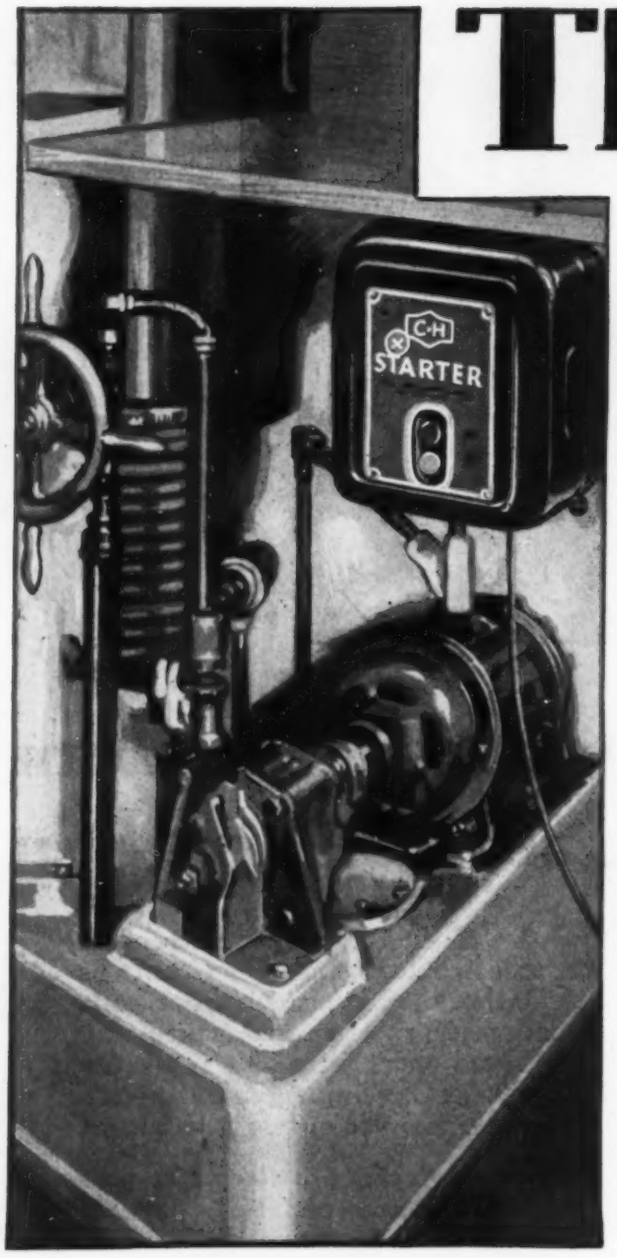
CLEVELAND AUTOMATICS
MEET THEM at the SHOW

THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 E. 65th St., Cleveland, Ohio,

NEW YORK
95 Liberty Street

CHICAGO
565 W. Washington Boulevard

DETROIT
1217 Book Building



This *always* *means* . . . Quality first in Machine Building

THE parts purchased by any manufacturer for the machines he builds to sell, provide a true measure of his own ideal of quality.

The name Cutler-Hammer on the Motor Control of a motor-driven machine means quality first in machine building . . . conscientious effort to guarantee maximum earnings on your investment.

Reserve quality is built into Cutler-Hammer Motor Starters . . . *Built* to the *Standard* of *Millions* of *Operations.* They are backed by over a quarter century of success in solving the Motor Control problems of every industry . . . an experience enabling C-H Engineers to develop pioneering features which assure accurate protection to motors, speedy manipulation of machines, safety to men . . . in short, the full earning capacity of the machine.

Alert machinery buyers use the C-H trade-mark on Motor Control as a guide in selecting motor-driven equipment. And realizing that there are no unimportant motors in the modern production chain, these executives standardize on Cutler-Hammer Starters for all motors . . . large or small . . . in their plants.

— 13 —

Thirteen Times the Manpower of Industry Hidden Away in Electric Motors

Electric Motors in America's industries today provide working capacity equal to 250 million workmen. That is more than 13 times the actual number of men employed. How effectively this army of "unseen" workers is used to bring down costs is determined by the care with which Motor Control is selected.

CUTLER-HAMMER, Inc.
Pioneer Manufacturers of Electric Control Apparatus
1282 St. Paul Avenue
MILWAUKEE, WISCONSIN

CUTLER HAMMER

The Control Equipment Good Electric Motors Deserve

C8620

This Hupp connecting rod has been milled in half to show you the drilled oil hole, ¼" in diameter and 8" long, that runs as true as the bore of a sporting rifle from crankshaft bearing to wrist pin. It delivers oil perfectly, under pressure, to tightly fitted wrist pins.

RIFLE DRILLED RODS!

at high production speed!

Here is the newest way that automotive connecting rods have been approved. Now oil is delivered to wrist pins with bullet precision, because rods are rifle-drilled at high production speed. The new Pratt & Whitney 6-Spindle Deep Hole Driller has made it possible.

Connecting rods have been drilled before, but never with the speed and ease that this machine does it. Now rods are drilled with a ¼" hole from end to end with a machine production of between 50 and 60 an hour with a single operator.

This new machine uses the well known rifle drilling principle, but does it vertically instead of horizontally. This one change means a big saving in floor space, and natural gravity helps to speed up the entire process. The drill is held stationary underneath, and the revolving work feeds down to it. Loading and unloading work is simplified and is done very quickly.

Nor are connecting rods the only work for which this machine is suited. It drills the tell-tale holes in staybolts at the same high speed. And there are many more similar drilling jobs that require long true holes for which this machine is ideal.

There is a new circular telling about this machine which has just gone to press. In it are full mechanical and production details. We will be glad to reserve a copy at your request.

PRATT & WHITNEY CO., *Hartford, Conn.*
Division NILES-BEMENT-POND COMPANY

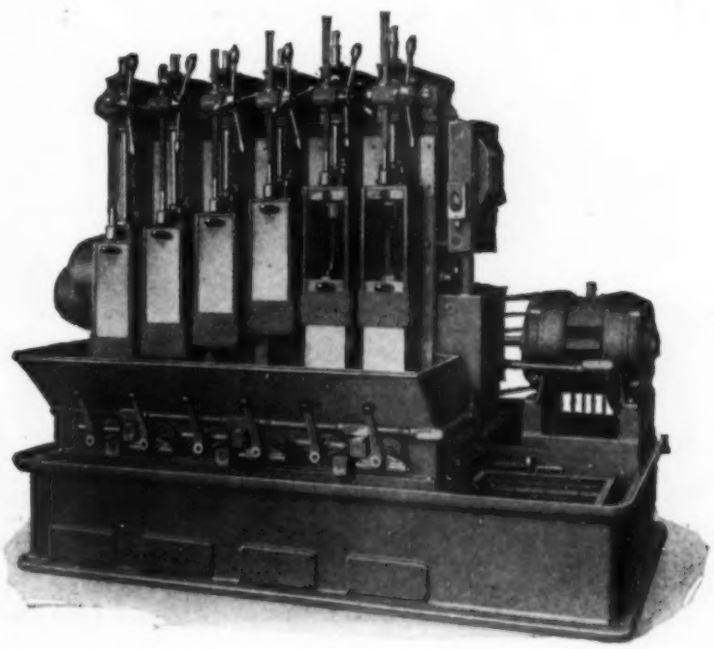
Sales Offices

BIRMINGHAM	CINCINNATI	LOS ANGELES	PITTSBURGH
BOSTON	CLEVELAND	NEW YORK	ROCHESTER
CHICAGO	DETROIT	PHILADELPHIA	ST. LOUIS
	SAN FRANCISCO		

One every 67½ seconds

PRATT & WHITNEY

6-spindle DEEP HOLE DRILLER



Notice the compact design of this machine, requiring very little floor space compared to other methods. It is approximately 8 feet long and 5½ feet deep. As shown the four spindles at the left carry rods being drilled, a rod has just been inserted in the next spindle, and the sixth is about to be loaded.

Are You Trying to Squeeze the Last Bit of Service from Your Old Lathes?

FAITHFUL, old lathes—stand-bys that have repaid their cost many times over. Once they were the best that could be bought—and set up production records that at the time were unusual. But since that time they have slipped so gradually into a state of obsolescence that their high cost of operation is not fully realized.

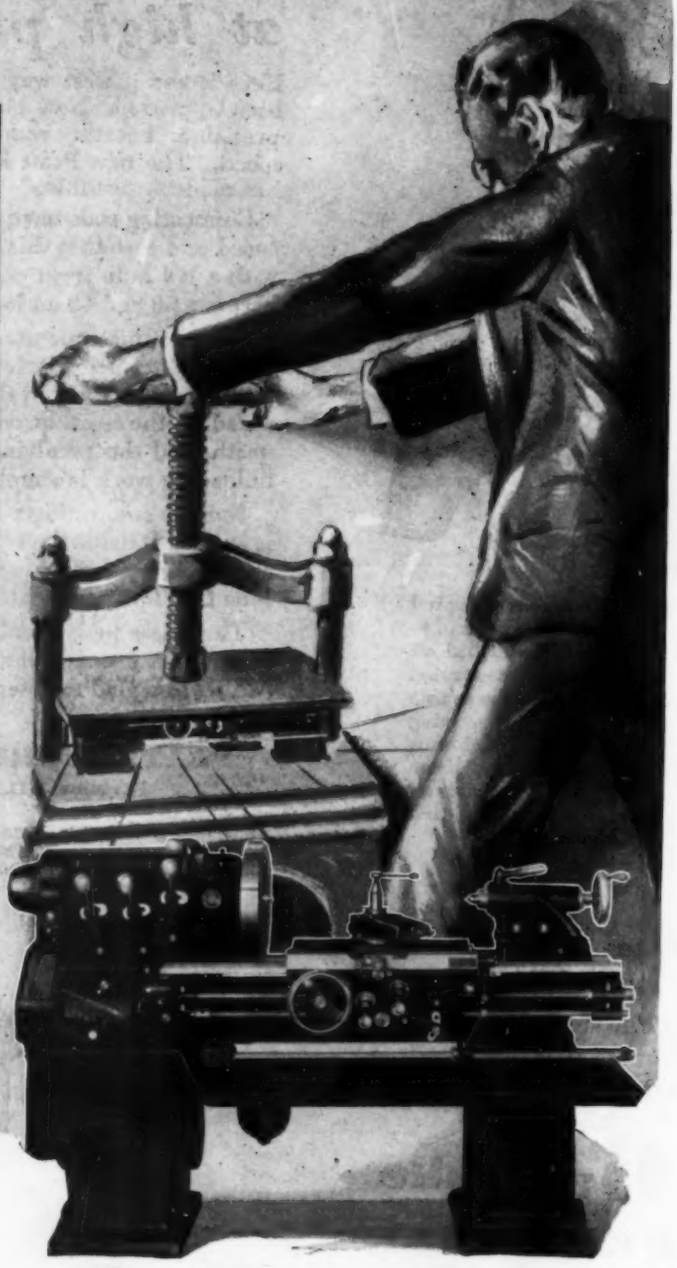
This is the story of thousands of lathes that should have been scrapped years ago—lathes whose owners insist on squeezing out of them the last bit of service they can give, regardless of the cost of doing so.

When production decreases—when operating costs go up—when rejections because of inaccuracy become too frequent—then it's time to scrap the old lathes. Replace them with Monarch High Speed, Helical-geared, Timkenized Lathes—designed in 1929. They increase production, produce smoother finished work, reduce cost per machine hour and handle the new cutting tools economically.

Write for new bulletin "Additional Reasons Why Monarch Lathes Should Be Your Choice."

THE MONARCH MACHINE TOOL CO.
Sidney, Ohio, U. S. A.

New York Sales Office:
857 Graybar Bldg.



Monarch lathes

Helical Gears - Timken Bearings

SMOOTHER..QUIETER..MORE POWERFUL

A machine that is as talented as the Diemakers that use it—

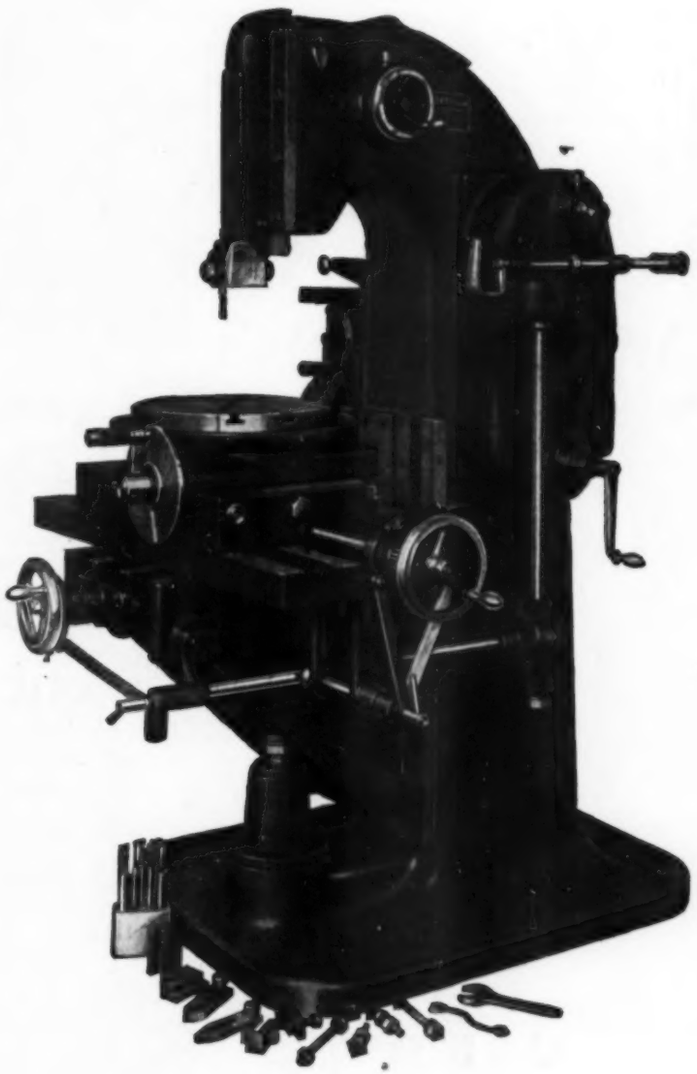
DIE-MAKING is a slow, costly process chiefly because it requires so much handwork. But it need not be if your men are provided with the proper equipment.

Because the Hanson-Whitney Universal Die Shaper can be employed on so many different operations, it invariably introduces economies that average *forty or fifty per cent.*

The length of the stroke of the Ram can be varied at will while in motion. The tilting table permits putting on the proper clearance. It is fitted with an accurate indexing mechanism and contains a *power* cross and longitudinal feed.

The speedy, universal machine possesses many other features that widens its scope. Once you examine its possibilities you will never be content to go along without one.

Ask us to mail illustrated bulletin describing it in detail.



DOMESTIC REPRESENTATIVES

New York, N. Y., L. C. Bigelow & Co., Inc.; Syracuse, N. Y., George McPherson; Boston, Mass., D. J. Normoyle; Pittsburgh, Pa., William K. Stamets; Cleveland, Ohio, William K. Stamets; Cincinnati, Ohio, Seifreat-Elstad Mchy. Co.; Dayton, Ohio, Seifreat-Elstad Mchy. Co.; Detroit, Mich., A. G. Brice; San Francisco, Calif., A. H. Coates Co.; Chicago, Ill., E. H. Huntington; Toronto, Montreal and Vancouver, Machine Tool Co.; Canada, Arthur Jackson.

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The Hanson-Whitney Machine Company

Hartford, Conn., U.S.A.

Gray Planers

Doesn't it stand to reason that a concern building nothing but planers, and that has built them for forty-seven years, must have the experience necessary to build them properly?

Planers are our sole product. Our entire plant—all our equipment, all our energy—everything is devoted to just one thing and that is—building planers.

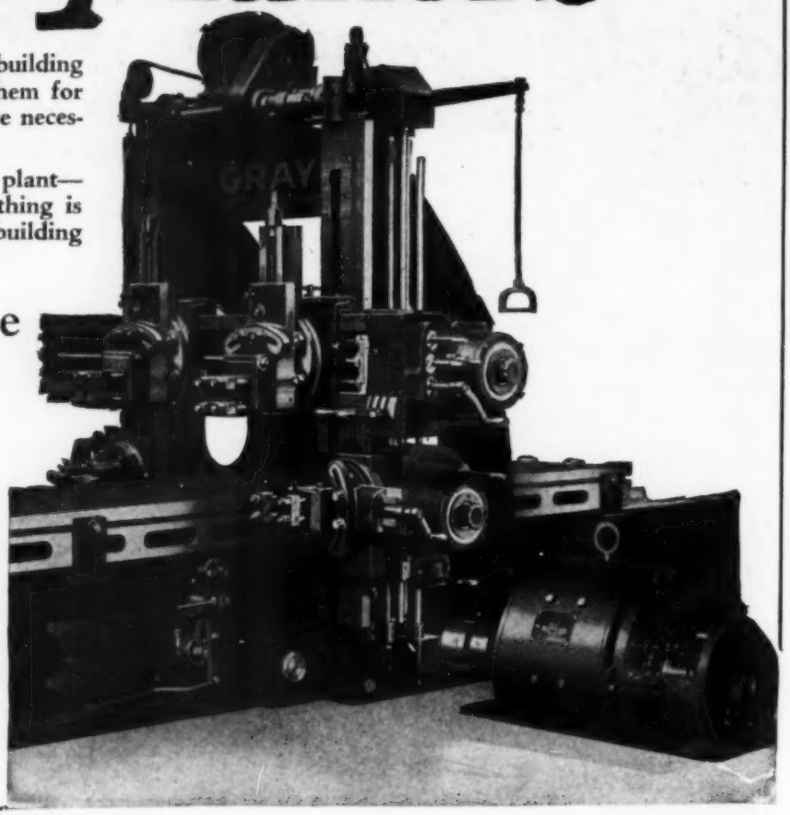
Gray Maximum Service Planers

are the culmination of these forty-seven years of planer building experience. They represent the highest development in the planer field today. They are in use in all kinds of shops and on all kinds of work.

Maximum Service Planers:
Open-Side and Double Housing

Manufactured by

THE G. A. GRAY CO.
CINCINNATI, OHIO



CARD
Spiral Pointed
TAPS

The CARD Quality

Practically "specials" but listed as stock

In fact every CARD Quality Threading Tool is a "special" from the standpoint of performance.

These CARD Spiral Pointed Taps are designed especially for tapping deep through holes in all kinds of metals.

Also, for tapping blind holes deep enough to allow for chip clearance at bottom of hole, these CARD Taps prove superior.

Try them. That's a step which usually leads to the use of CARD Taps exclusively.

See Catalog No. 32 for complete listings of this and other style CARD Quality Taps.

S. W. CARD MFG. CO.
Division of Union Twist Drill Co.
MANSFIELD, MASS., U. S. A.
N. Y. Office: 52 Reade Street

Study These Improvements in Oesterlein-Aurora Drills

OESTERLEIN Aurora Drills are built in 10 sizes to meet every requirement in an upright drill. They may be equipped with patent tapping attachment, making them adaptable for tapping, as well as reaming, burring, spot-facing and drilling.

The Aurora Drill is a very useful piece of supplementary equipment for the assembly department; it is a dependable machine that you can rely on for steady, day-after-day service—a machine that will always give complete satisfaction.

The quality of the workmanship has been greatly improved—making the Aurora a better built drill than ever before.

Guarantee

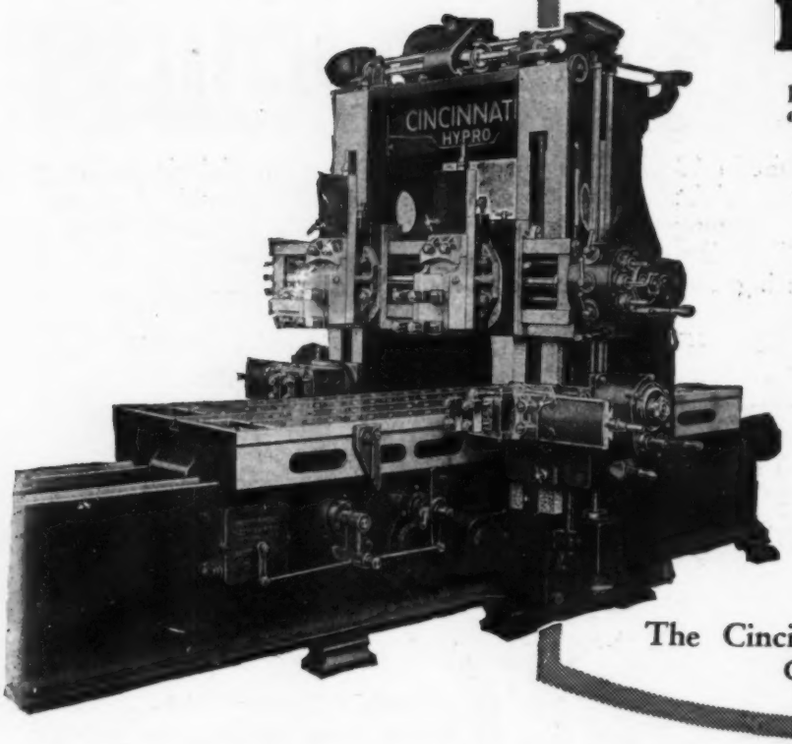
Oesterlein Drills are sold on an absolute guarantee of satisfaction. They are fully warranted as to materials, workmanship and performance. If the purchaser of an Aurora Drill is not completely satisfied he may return the drill to us. *Write for new drill Catalog.*

THE OESTERLEIN MACHINE CO., CINCINNATI, OHIO, U. S. A.

OESTERLEIN OHIO
MILLING GRINDING DRILLING
EQUIPMENT

CINCINNATI HYPRO

PLANERS



produce more with less operating effort.

Read on—see why!

NO unnecessary reaching for levers to move head or rail

NO Oilers to be forgotten

NO chatter on finished work

NO Springing of Rail Heads

NO springing of Side Heads

NO springs or jaw clutches to get out of order

Now get the full story from Hypro Engineers.

The Cincinnati Planer Company
Cincinnati, Ohio

New Single Lever Control

In an instant, the selection of any one of a wide range of spindle speeds is possible by means of a single lever in the New G. K. Single Lever Control Heavy Duty Lathes.

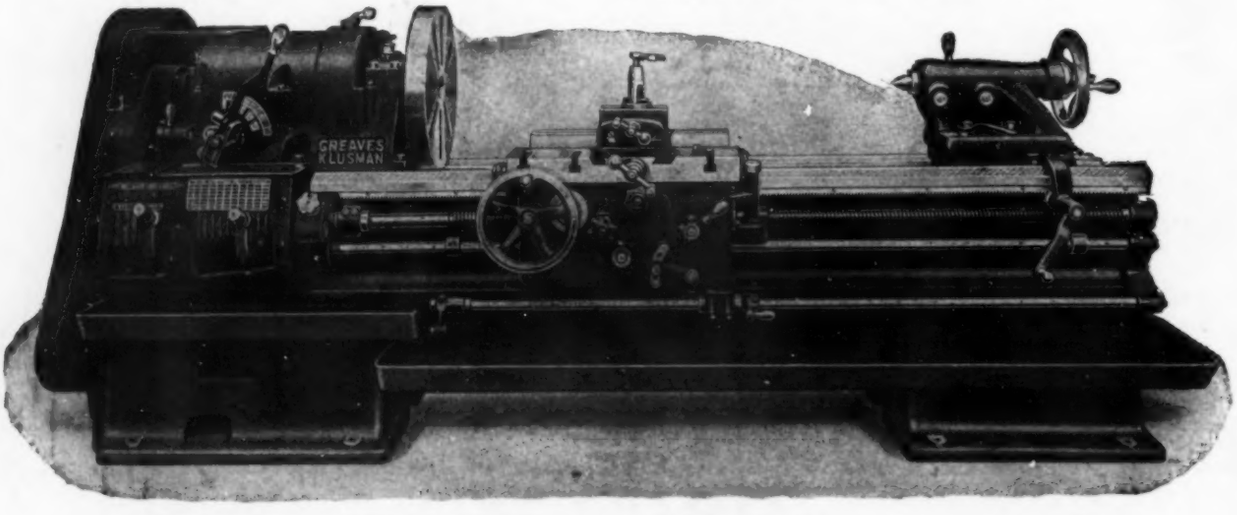
Operation is thus minimized and output appreciably increased.

Machining losses are lowered and profits raised to a higher level.

This feature is a benefit to a new operator. He steps into place and keeps pace with the "old timers."

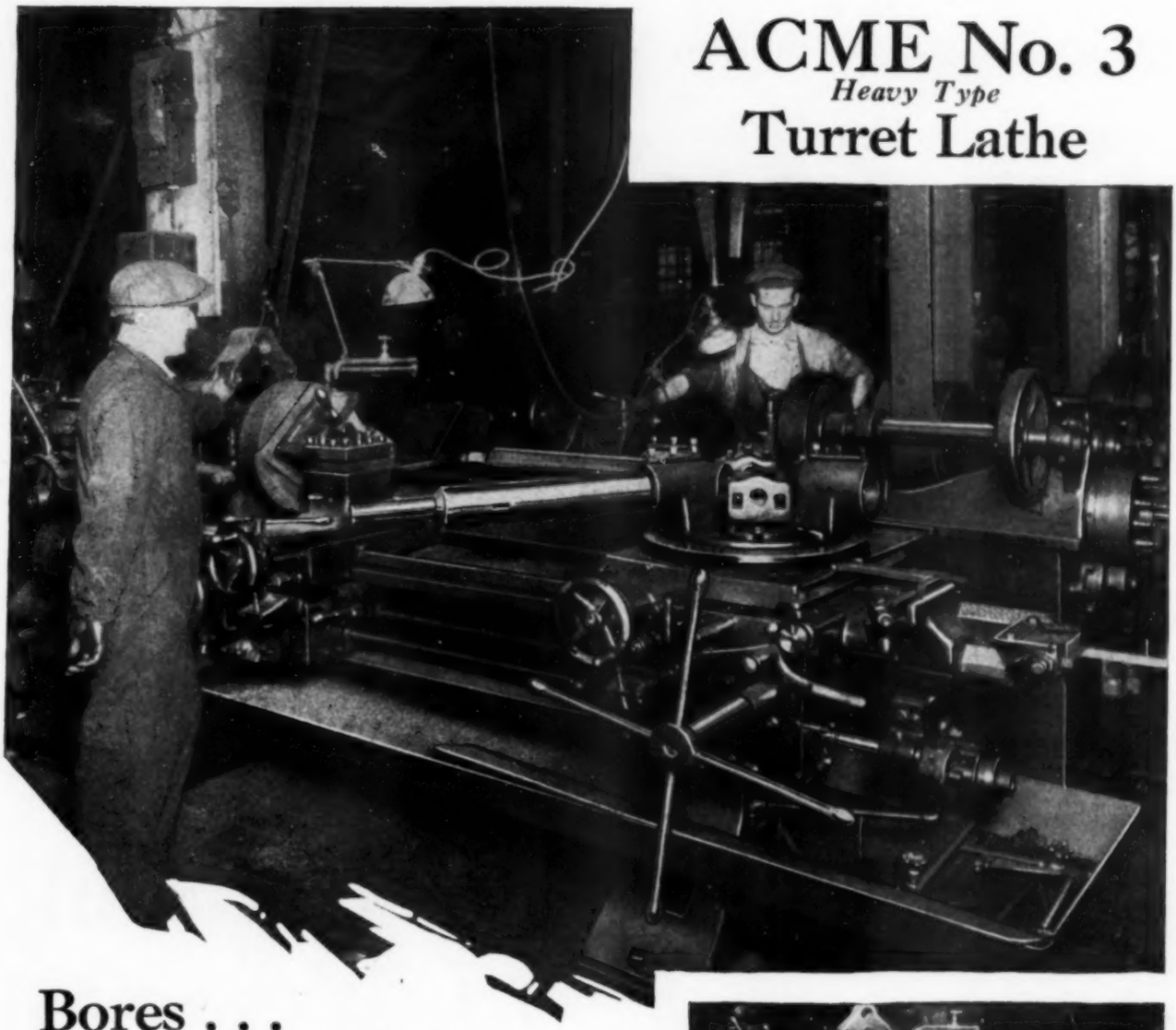
This new Lathe, with its simplified system of operation, gives far longer service.

The many production features incorporated in this tool are detailed in the catalog.



The Greaves-Klusman Tool Co., Cincinnati, Ohio

ACME No. 3
Heavy Type
Turret Lathe

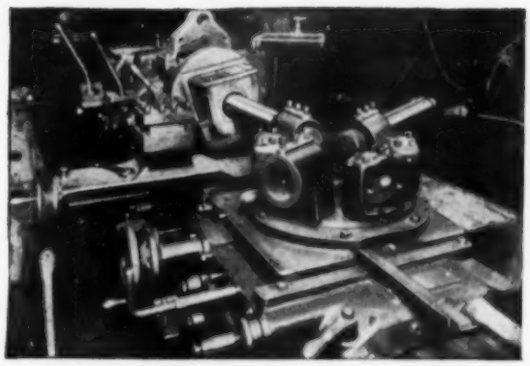


Bores . . .
Faces Two Holes
8 Pieces an hour—

The above picture shows a Cincinnati Acme No. 3 installation in one of the largest air compressor plants in the middle west.

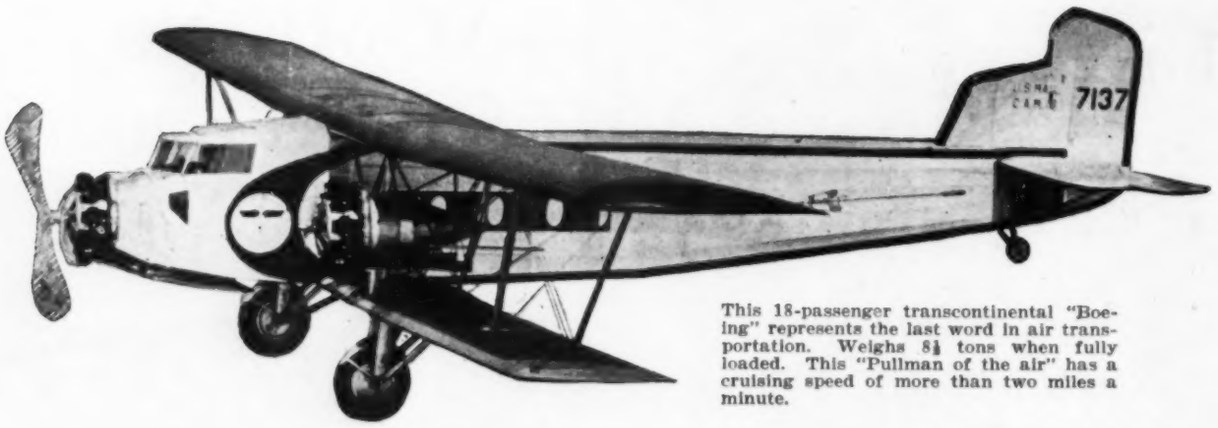
Seven other Acmes in this plant is further evidence of Acme range and performance on any kind of turret lathe operations.

We will gladly quote estimates from your Blue Prints. *Send them in.*



A close-up of tool set-up. Piece is Roller Bearing Compression crank case for air Compressors. Operations rough and finish bore two holes of different diameters. Production, 8 pieces an hour.

The ACME Machine Tool Company
4955 Spring Grove Ave., CINCINNATI, OHIO



This 18-passenger transcontinental "Boeing" represents the last word in air transportation. Weighs 8½ tons when fully loaded. This "Pullman of the air" has a cruising speed of more than two miles a minute.

Another great tribute to Hendey Lathes

Aeroplane construction and maintenance calls for machine precision as great, if not greater than in the automotive industry.

So what was more natural for the Boeing Airplane Company, Seattle, manufacturers of mail planes carrying nearly one-half of the nation's air mail, and of many commercial and military models ranging from 18-passenger transports to high speed military fighting ships, than to turn to machines long noted for their high quality and precision standards.

Here you see their lathe department equipped entirely with Hendey Lathes. Eight "tie bar" models are steadily engaged in keeping this, the world's largest plant of its kind, turning out all manner of difficult work.

"Hendeys" are the logical choice where high standards and costs are matters of complete understandings.

The Hendey catalog illustrates all models of cone and geared head lathes—write for your copy.

LATHES SHAPERS

HENDEY
MACHINE CO., TORRINGTON, CONN.

MILLING MACHINES

"THE STANDARD OF QUALITY SINCE 1870"

You can PROFIT *from Our experience*

Shaw 250-ton Railroad Shop Cranes.

THE policy of each crane installation being considered as an individual problem has proven a huge factor in the successful operation of Shaw Cranes. When special features are required to best meet the user's needs they are incorporated.

Shaw 10-ton Stone Yard Crane.

Shaw 10-ton Crane in Naval Airplane Plant.

The Shaw Crane Engineers have at their command facilities to produce, economically, every type of Crane. Their advice to a prospect, therefore, is not biased by the need to sell an unchangeable product but is limited only by the user's requirements.

Shaw 15-ton Gantry Grab Bucket Crane.

To derive the utmost benefit from this very intelligent method of service, call a Shaw Engineer into consultation before you even start the preliminary plans for a Crane installation. He will, without obligation to you in any way, give impartial advice. It is of great value.

Shaw 10-ton Crane general utility type.

Shaw 12-ton Yard Crane with Electro Magnet.

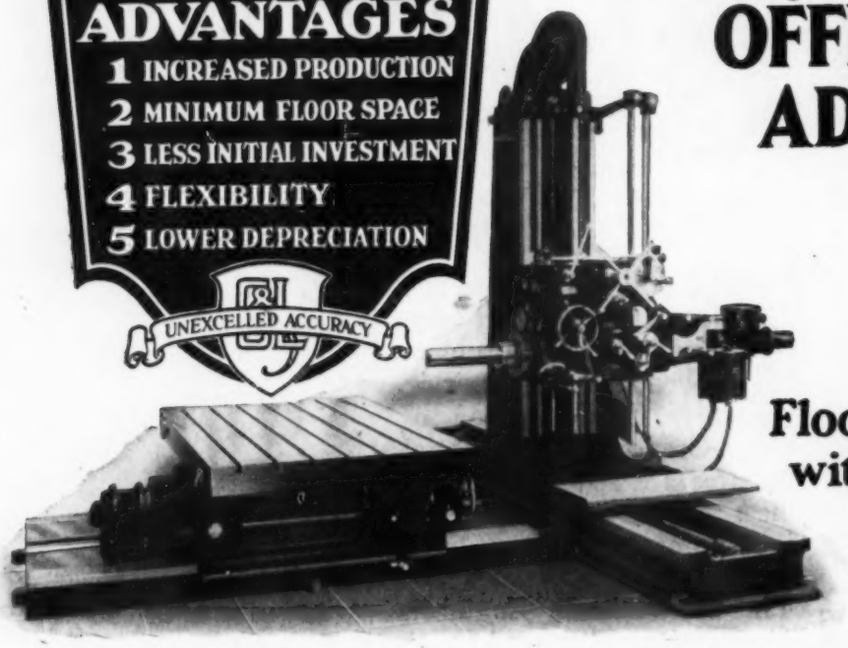
Shaw Electric Traveling Cranes
Manufactured at
Muskegon, Mich.

Owned by

MANNING, MAXWELL & MOORE, Inc.

The G&L Method Offers These Advantages

BIG ADVANTAGES
1 INCREASED PRODUCTION
2 MINIMUM FLOOR SPACE
3 LESS INITIAL INVESTMENT
4 FLEXIBILITY
5 LOWER DEPRECIATION
UNEXCELLED ACCURACY



Floor Type Machine with Precision Power Revolving Table

Specialists in Horizontal Boring, Drilling and Milling

GIDDINGS & LEWIS MACHINE TOOL CO.
Founded 1859
FOND DU LAC, WISCONSIN

Tapping Speeds Are Going Up—

(SPECIAL PRODUCTION TAPS)

THIS specially designed Butterfield Production Tap has taught many users that good threads can be produced at relative higher speeds.

The spiral points actually shear the metal, throwing the chips ahead and take much wear off of the thread section.

Good in any kind of material but particularly so in tough, stringy forgings and bronzes.

Higher Tapping speeds, less breakage and finely finished threads recommend this design.

BUTTERFIELD & CO. Union Twist Drill Co. DIVISION
Derby Line, Vt., U. S. A.
Rock Island, Quebec, Canada

Stores: New York, 62 Reade St. Chicago, 11 So. Clinton St. Detroit, 406 E. Woodbridge St. Toronto, 67 Adelaide St., West. Montreal, 121 St. Paul St., West.

BUTTERFIELD THE BETTER TOOLS

Four Tools in One ~
The Sellers Floor Boring Machine

Setting-up time on many jobs can be reduced one-half, one-third—and, in some cases, even more, by using a Sellers Floor Boring Machine.

This multi-purpose tool does the work of boring machines, planers, drill presses and milling machines, performing any necessary combination of operations on a piece of work with but one set-up.

Sellers Floor Boring Machines are built in floor plate, planer bed and revolving table types, in sizes from 4" to 10" spindle. A booklet describing many new features and refinements of design, together with specific operating advantages and illustrations of all types of Sellers Floor Borers, will be mailed at your request. Send for it today.

WILLIAM SELLERS & CO., ***Incorporated***
Philadelphia, U. S. A.

The Sellers 8" Spindle Floor Boring Machine, planer table type.

Keen Competition Demands Efficient Machine Tools

Replace the sledge hammer for drive fit work.

It cannot compete with the

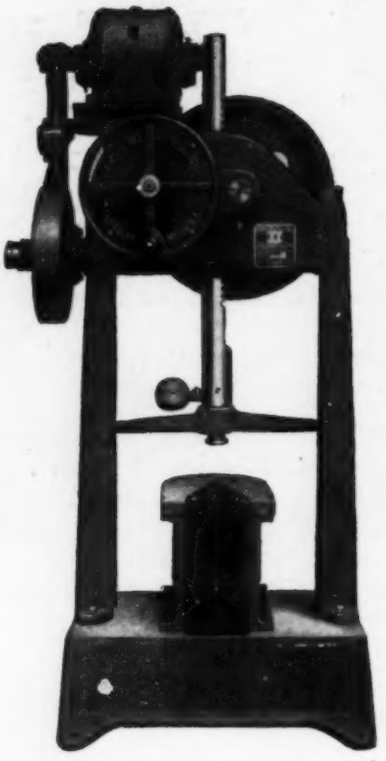
LUCAS
POWER FORCING PRESS

The belt does the work and saves the workman's time and energy for better use.

THE LUCAS MACHINE TOOL CO.

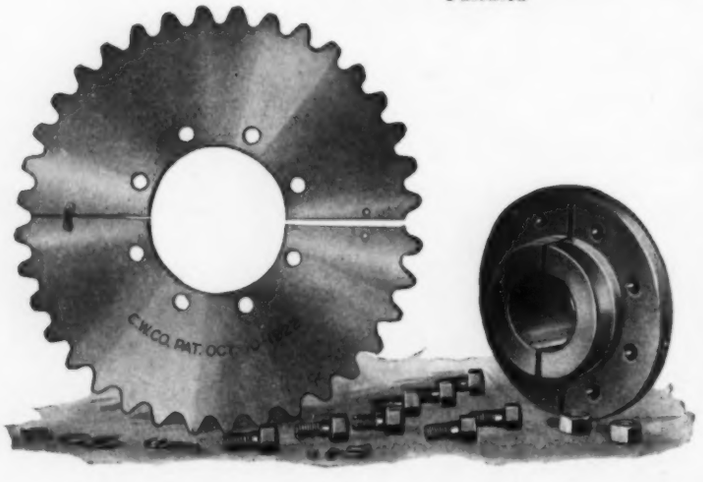
NOW AND ALWAYS OF

Cleveland, Ohio, U.S.A.



Cullman Sprockets
SPLIT and SOLID

Patented



"One or a Million"

Specializing in sprockets, the Cullman Wheel Company is singularly well equipped to supply your wants in the line at an adavntageous price and in any quantity.

Especial attention is called to the Cullman patented Split Sprocket, the advantages of which are so obvious that it is scarcely necessary to explain wherein they lie.

It is far easier to replace a worn Cullman Split Sprocket. The same ready interchangeability is experienced when it is desired to utilize a sprocket with more or less teeth. In other words, the Cullman Split Sprocket has the same advantage over the solid sprocket that the split pulley has over the solid pulley.

Write for catalog showing sizes and types.

CULLMAN WHEEL COMPANY
1349 Altgeld St., Chicago, Ill.

there must be no holdups here—

BOLTS and nuts are the principal products of the Wm. H. Haskell Mfg. Co., Pawtucket, R. I. All sizes, all styles are constantly "going through." Quality of thread is of prime importance, but speed in output is imperative.

To obtain both in full measure, LANDIS Threading Equipment is employed.

There are twenty LANDIS Double Head Threading Machines and one LANDIS Single Head Threading Machine continually in service.

The part being threaded, above, is a ½-in. square head, forged steel bolt. A thread 1 in. in length is cut and production averages 6,000 bolts per day.

Here's a point to consider: 10,000 bolts—"steel"—are threaded between Chaser grinds.

The cure for threading troubles is invariably found in LANDIS Threading Equipment.

Let us give you more proof. Write for Catalog No. 32.

LANDIS CHASER

A FINAL THOUGHT

The distinctive design of LANDIS Chasers has a three-way bearing on profits: PRODUCTION—Free cutting action. Less down time for regrinding. LOW DIE COST—Longer chaser life. More threads between grinds. ACCURACY—Shearing action reduces the cutting strain and consequent thread distortion. Variable rake angle insures smooth, well-formed threads. As it is not necessary to grind into "leading portion" of chaser, accurate lead is maintained. Being ground on the cutting edge, the chaser can be used for "close-to-shoulder" threading throughout its entire life.

LANDIS MACHINE COMPANY, Inc.

Waynesboro, Pa.

Detroit Office: 5928 Second Blvd.

DOMESTIC AGENTS: Young & Vann Supply Co., Birmingham, Ala.; Herberts Machinery & Supply Co., Los Angeles, Calif.; Herberts Moore Machinery Co., San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; R. S. Armstrong & Brother Company, Atlanta, Ga.; Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Co. of Indiana, Indianapolis, Ind.; Woodward Wight & Co., New Orleans, La.; Shreveport, La.; Tampa, Fla.; R. B. Whitacre & Co., St. Paul, Minn.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; Harry M. Euler Company, Portland, Ore.; Hamilton Machy. Co., Chattanooga, Tenn.; D. S. Mair Machinery Co., Houston, Texas; Salt Lake Hardware Co., Salt Lake City, Utah; Hallidie Machinery Co., Seattle, Wash.; Hallidie Company, Spokane, Wash.

CANADIAN AGENTS: Canadian Fairbanks Morse Company, Montreal, Toronto, Winnipeg, Vancouver.

FOREIGN AGENTS: Benson Brothers, Ltd., Sydney; Schuchardt & Schutte, Berlin, Vienna; R. S. Stokvis & Zonen, Rotterdam; Brussels; M. Almeida & Cia., Sao Paulo; Rio de Janeiro; Alfred Herbert, Ltd., Coventry; Calcutta; Osaka; Burton Fils, Paris; D. Drury & Co., Johannesburg; Akt. C. A. Herstad, Copenhagen; Ing. Ercole Vaghi, Milan; Allied Machinery Co., Barcelona; Zurich; Akt. Gunnar Ekstrom, Stockholm.

1000 Lbs.

or

100 Lbs.

One thousand pounds or one hundred pounds—it makes no difference when you use the rugged New Britain All Steel Work Stands.

A handy work stand is as important a factor in daily net production as the tooling and lubrication of the equipment itself.

Standard or special work stands for every manufacturing need.

Write direct or see your nearest jobber about New Britain All Steel Shop Furniture.

"Originators of Shop Furniture"

THE NEW BRITAIN MACHINE COMPANY

New Britain, Conn.

All Steel Work Stand with two trays on Riveteless Socket Castors.

All Steel Work Stand with two trays on Riveteless Socket Feet.

All Steel Work Stand with three trays and steel drawer.

$5,000.00 INVESTMENT RETURNS 55%

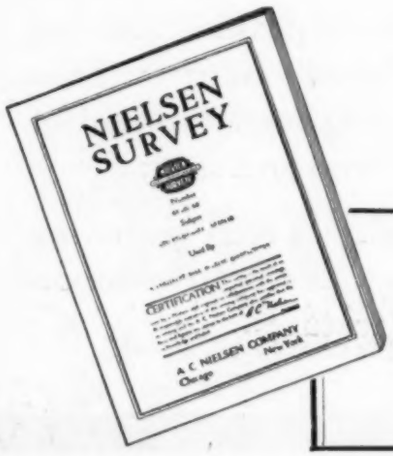
Prominent ball bearing manufacturer endorses method of saving $2970.00 annually on each of four machines . . .

THE first machine was installed "on trial" and operated under the severest test conditions. A group of engineers of the A. C. Nielsen Company carefully checked its production, its operative costs, its maintenance costs, its efficiency, and the results were so amazingly satisfactory that this prominent ball bearing manufacturer ordered a battery of *"Hydro-Matic"* Grinders.

The survey showed that the original investment will be returned in less than two years. Production was increased approximately 157% and the number of rejections actually reduced in spite of the tremendous increase in production.

As these are but a few of the advantages offered by the *Greenfield "Hydro-Matic"* Grinder, a copy of the complete Nielsen Survey will give you a real picture of the remarkable qualities of the machine.

A few copies are available for executives. Asking for one will obligate you in no way. Just fill out the coupon and return it to us.



MACHINE TOOL DIVISION

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

NEW YORK: 15 Warren St.
CHICAGO: 611 W. Washington Blvd.
DETROIT: 228 Congress St., W.

Canadian Plant: Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ontario

European Office:
Greenfield Tap & Die Corp., Ltd., 139 Queen Victoria St., London, E. C. 4

GREENFIELD TAP & DIE CORP., Greenfield, Mass.

Gentlemen:
Please send me a copy of the Report of the Nielsen Survey made at the plant of a prominent ball bearing manufacturer.

Name .....

Address .....

City ..... *State* .....

For the most EFFICIENT METHOD of Screw Machine Production from brass and other free-cutting rods —specify BROWN & SHARPE HIGH SPEED AUTOMATICS

THE Brown & Sharpe High Speed Automatic Screw Machines offer rapid production in a thoroughly modern sense. By choosing these machines for turning out accurate interchangeable parts you benefit by the experience of manufacturers everywhere who have found this method the most efficient.

The High Speed Automatics are designed throughout for rapid operation, and the following are notable features of this design:

First, they provide unusually high spindle speeds (in the No. 00 Machines up to 5000 R.P.M.);

Second, idle movements, such as feeding the stock and indexing of the turret have been speeded up. Faster cutting feeds for the tools are possible, assuring greatly increased production from brass and the free-cutting materials and of small parts from iron and steel;

Third, these machines offer the swing stop and double indexing, two important time-saving features.

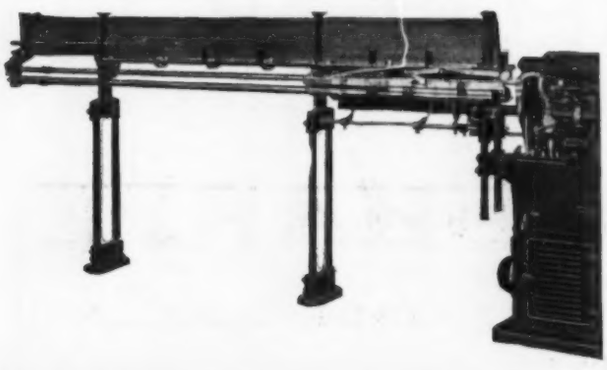
For Still Greater Net Production—
the Automatic Rod Magazine

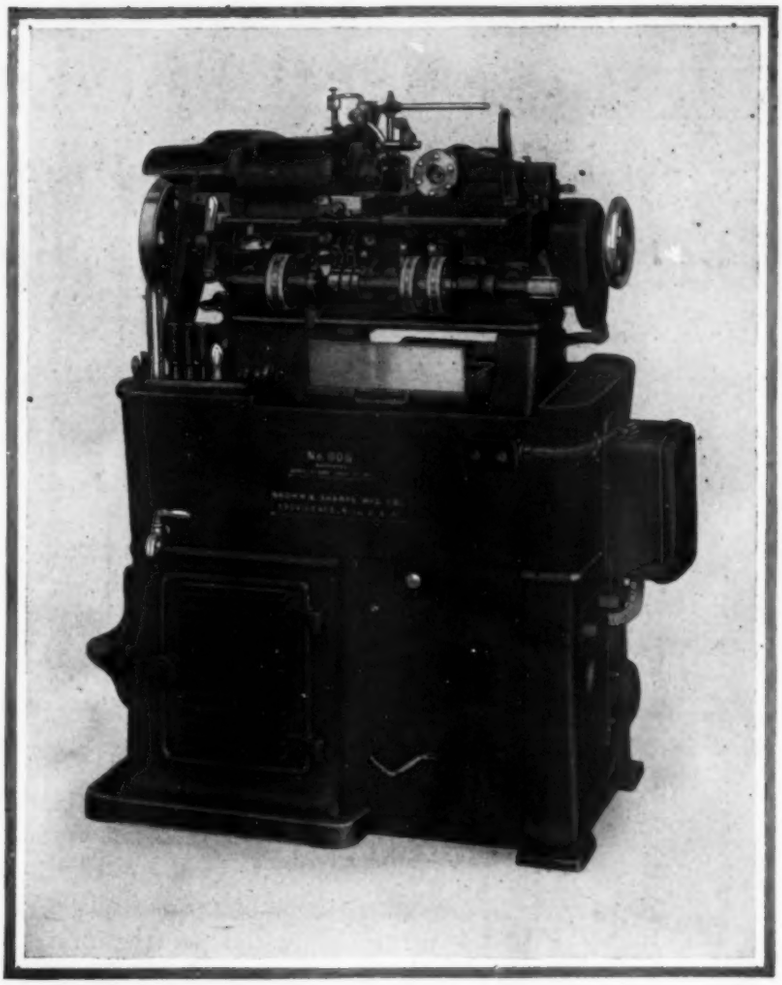
for all

BROWN & SHARPE Nos. 00 and 0
Automatic Screw—Turret Forming—
and Cutting-off Machines

and No. 00 Automatic
Screw Threading Machines

Write for descriptive circular





Write for specifications, and ask our representative to tell you more about the High Speed Automatics. When desired, our Screw Machine Service Department will design and make Cams according to your specifications for the part to be made or will plan set-ups for special or difficult jobs. Take advantage of the broad experience of men who have designed and built thousands of production set-ups.

The HANDBOOK *for the Buyer of Machine Tools, Small Tools, Cutters, and Shop Equipment*

The BROWN & SHARPE
No. 139
GENERAL CATALOG
If you have not received your copy write for one today.

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

"Look at the Button-Holes and the Lining"—The Super*

"This file advertisement reminds me, Kennedy, that I need a new suit."

"Tell me, Hawkins, do *you* look the button-holes and lining over before you buy a suit?"

"Well, with this ad in mind, I'm sure I won't buy my next suit without looking it over to see if it is well made. Style and looks aren't the only things with me. Take these files as another example. The manufacturer even makes his own steel, leading me to believe that he is putting a lot of care on each operation in producing his product."

"Personally, I can't tell good cloth when I see it, so I buy the suit that seems to stand up best. I have found that the linings of A Company go to pieces in no time, and that the linings of suits from B Company last as long as the suit. Everything else is about the same, so I figure that A Company is gypping me out of a lining every time I buy of them."

"Results are the final answer, of course. Take this clutch for example. It is operated approximately 2,000 times per day. How's *that* for results?"

"Very good, Hawkins. You're thinking now of our own machine. Yes, this service is very much like our case."

"Instead of turning the motor off every few seconds and then starting up under full load as we foolishly did on the first few machines, and instead of the present home-made solid clutch, we need one of these types that will absorb the shocks and smooth out the operation of the machine."

"Such a clutch would soon pay for itself in reduced wear and tear on the mechanism."

"Right. We better look to our own product, Kennedy, to see if our button-holes and lining will stand inspection. Let's not have our customers feeling that we have gypped them out of a good clutch."

**The above is typical of conversations that are taking place in shops and offices all over the country, demonstrating the fact that production and engineering executives are the ones who decide on the purchase of new equipment for their plants, as well as parts and materials for their products.*

Sure it's a good shop look at these Starrett "Mikes"

When your tool crib has the Starrett Micrometer Set No. 436 your men can handle most any "miked" job right.

Ranges of sets are 0 to 6", 6 to 12", and 0 to 12", with or without ratchet stop, black enamel frames, built rugged for daily use, but above all they have Starrett dependability.

Write for the Starrett Catalog No. 24 "C" describing over 2500 Starrett Tools.

Starrett Micrometer Set No. 436

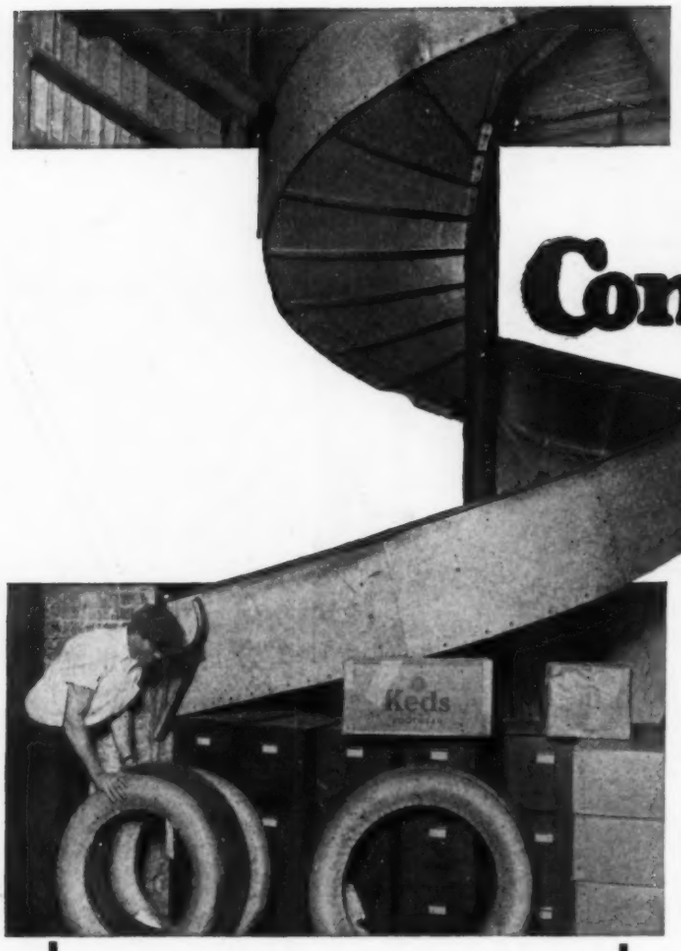
THE L. S. STARRETT CO.

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy

ATHOL, MASS., U.S.A.

Use Starrett Tools

2894



Every installation points out the advantages of our special

Construction

After a Standard Conveyor, any type, has been in service for a while, appreciation of our special construction grows. Of course there is only one answer for that and it is that we have studied conveying needs for heaviest duty and know how to build conveyors to meet any requirements. Note the description of the "down flanged runway" —that's just one of our special features—there are many more worth your investigation.

It will pay you to know "Standard" advantages. Our Conveyor Counselors will be glad to talk it over with you anytime—they may be of valuable aid to you in making your new production plans.

The Only Down Flanged Runway. What It Means

Segments or wings that make up the runway of the Standard Spiral are bent to a 90 deg. angle and bolted underneath. This leaves the runway smooth. It also reinforces the spiral because the bolted flanges form ribs or supports that add to the strength of the entire spiral. The illustration shows this construction. An exclusive and patented method of the Standard Conveyor Co.

STANDARD
CONVEYOR COMPANY

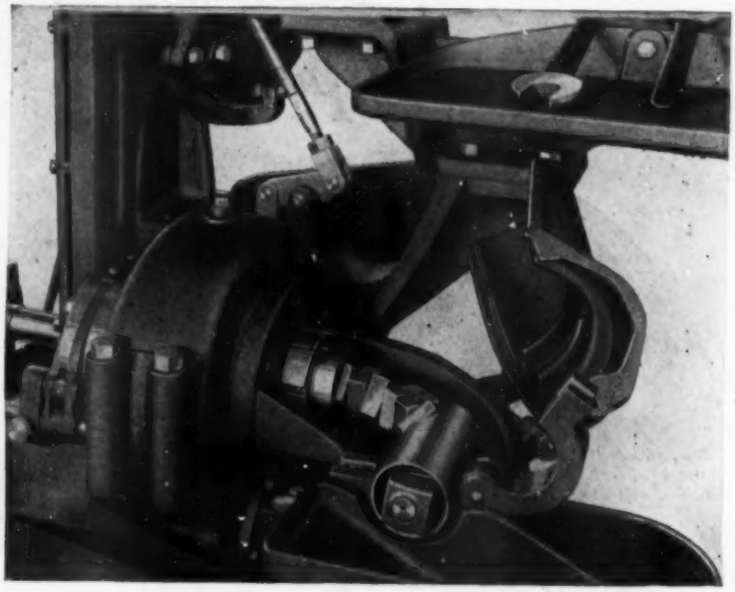
NORTH SAINT PAUL, MINNESOTA

Baltimore Office, 2125 Lyndhurst Ave.
Boston Office, 755 Boyston St.
Buffalo Office, 908 Ellicott Sq.
Chicago Office, 549 W. Washington St.
Cincinnati Office, 609 American Bldg.
Cleveland Office, 5005 Euclid Ave.
Dallas Office, 6313 Oram St.
Detroit Office, 420 U. S. Mortgage Bldg.
Kansas City Office, 215 Mfr. Ex. Bldg.
Los Angeles Office, 335 So. San Pedro St.
New Orleans Office, 1003 Magazine St.
New York Office, 420 Lexington Ave.
San Francisco Office, 4401 San Bruno Ave.
Seattle Office, 321 Lumber Ex. Bldg.

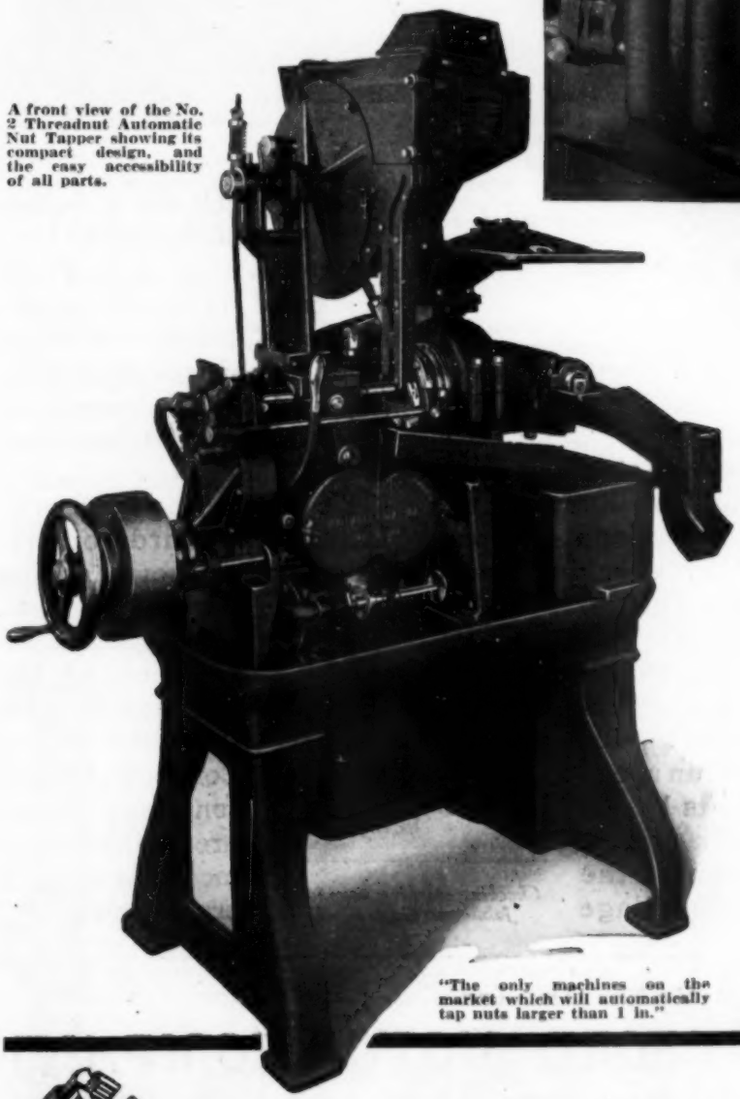
THREADNUT

THREADS THAT ARE SQUARE WITH THE FACE!

In the new Threadnut Automatic Tapper, the tap remains stationary and the nut revolves—each a balanced mass about the axis of the tap. This balanced rotation of every nut tends to hold the tap more truly central and square and to produce with amazing speed nuts whose "Threads are square with the face." Tap breakage and clogging are eliminated and production costs cut 25c. to 90c. per thousand on the No. 2 size and as high as $1.90 on the No. 3 size. Fully automatic.



A front view of the No. 2 Threadnut Automatic Nut Tapper showing its compact design, and the easy accessibility of all parts.



"The only machines on the market which will automatically tap nuts larger than 1 in."

The increased accuracy of every nut tapped on Threadnut Tapper means more ease of assembly wherever these nuts are used! Threadnut eliminates much trouble and expense for nut manufacturers and nut users alike. That's the reason why Threadnut tapped nuts are being specified so frequently by buyers.

No. 2 Threadnut capacity ⅝" to ⅞" wide

No. 3 Threadnut capacity 1" to 1½" wide

Every industry using or producing nuts in quantities should read our new folder. *Write for it!*

THREADNUT
TRADE MARK REG.

AUTOMATIC NUT-THREAD CORPORATION

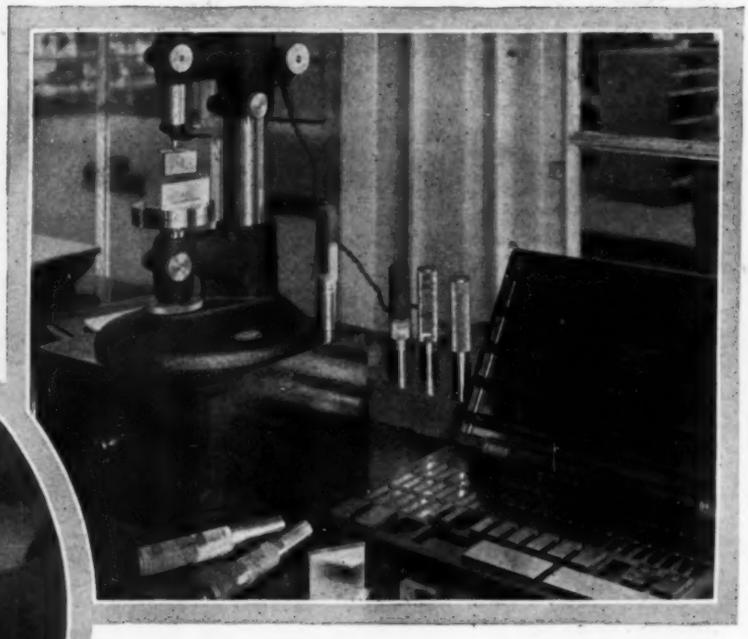
3617-19 N. 8th St., at Rising Sun Ave.
Philadelphia, Pa.

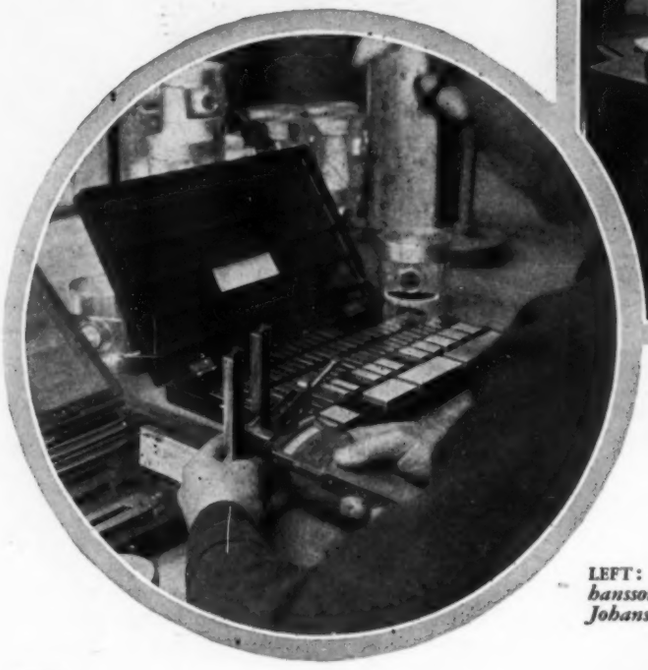
THREADNUT

THREADS THAT ARE SQUARE WITH THE FACE

Johansson Gages

determine the accuracy of FORD *and* LINCOLN *parts*





ABOVE: *Setting outside optometer with Johansson Gage Blocks and Accessories*

LEFT: *Setting internal Johansson indicator with the Johansson Gage Blocks and Accessories*

THE precision with which the new Ford car is built is one of the marvels of American industry. It makes possible quantity production with the assurance that every part will fit in assembly. Thirty measurements on each car have an accuracy of five ten-thousandths of an inch, *or less!* . . . With Johansson Gage Blocks this same precision is available to any manufacturer.

Johansson Gage Blocks are in constant use in the Ford and Lincoln plants and in many other automobile factories. Their chief service is to certify the accuracy of inspection and working tools and gages. Ford and Lincoln practice is to check all gages twice daily. Some of the Ford operations are protected by checking every hour. Snap gages, plug gages, micrometers and all other gaging instruments are kept within specified limits by the infinitely greater precision of the Johansson Gage Blocks, which are manufactured to an accuracy of two-millionths of an inch! These blocks of hardened, stabilized steel, finished by secret processes, are the most accurate and flexible measuring tools the world has ever known.

Checking working gage with Johansson Gage Blocks

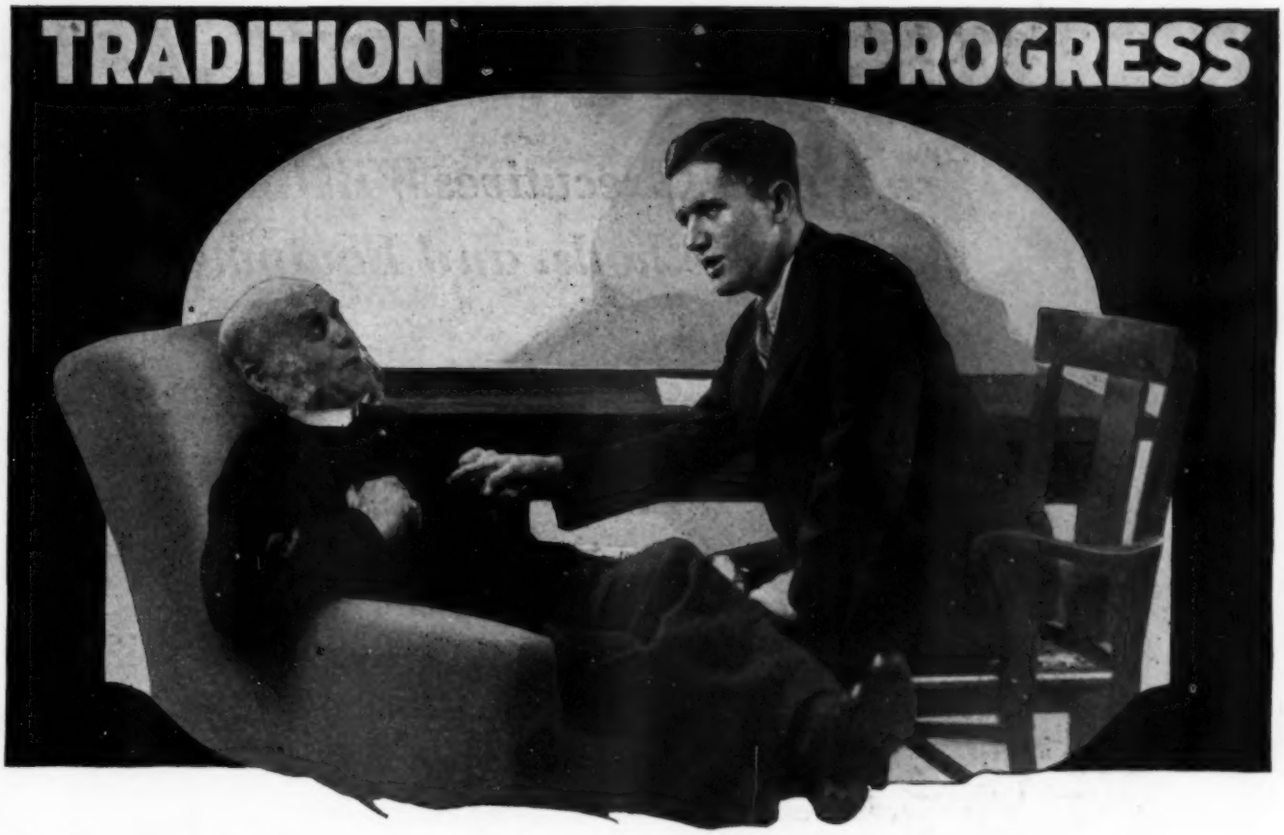
You can apply Ford-Lincoln standards of precision to your own gaging problems. Through the association of Mr. Johansson with the Ford Motor Company, Johansson Gage Blocks are available commercially at moderate prices.

C. E. JOHANSSON, *Inc.*

Division of **FORD MOTOR COMPANY**

Detroit, Michigan

Write direct or to your Mill Supply Dealer



"Here, Lad—

Up at the house last night we were talking about new shifts in trade.

I brought up the fact that you had been investigating motor practice in factories and found that the 'Linc-Weld' motor was being taken on in preference to all others.

My brother-in-law scoffed at the idea."

"Linc-Weld" Superiority is due to

1. **Larger Shafts**
2. **Larger Bearings**
3. **Better Insulation**
4. **Stronger Frame (Steel)**
5. **Greater Overload Capacity**

"Sure, Pop—

a scofflaw would.

Tell him that one plant I visited traced most of its shutdowns to bearing failures.

They changed to 'Linc-Weld' which has bearings and shafts almost twice ordinary size—and thus put the bee on that trouble.

Ask him to scoff that off!

And where's the scoff in a steel frame that can't break—in insulation that can't dry out and crack—in unapproached overload capacity?

Why, Pop, there's not a scoff in a carload!"

The Lincoln Electric Co., Dept. No. 3-6, Cleveland, Ohio

"Linc-Weld" LINCOLN MOTOR

M-42

ON JULY 18TH

Design and Production Executives Will Go Shopping for New Ideas, Methods, and Equipment

In the big semi-annual issue of *American Machinist,* known as the SHOP EQUIPMENT REVIEW AND CATALOG NUMBER (dated July 18), Design and Production Executives will actually and seriously go shopping through its pages for new ideas, methods, and equipment, for in no other place is such a wealth of information and of such vital importance to design and production executives, assembled at one time.

This issue not only contains an interesting review of all new equipment and improvements developed during the preceding six months (over 400 items anticipated), but also an unusual amount of "Catalog style" advertising paralleling the editorial contents combining to make the issue a genuine reference number as it has been appropriately termed by its many readers.

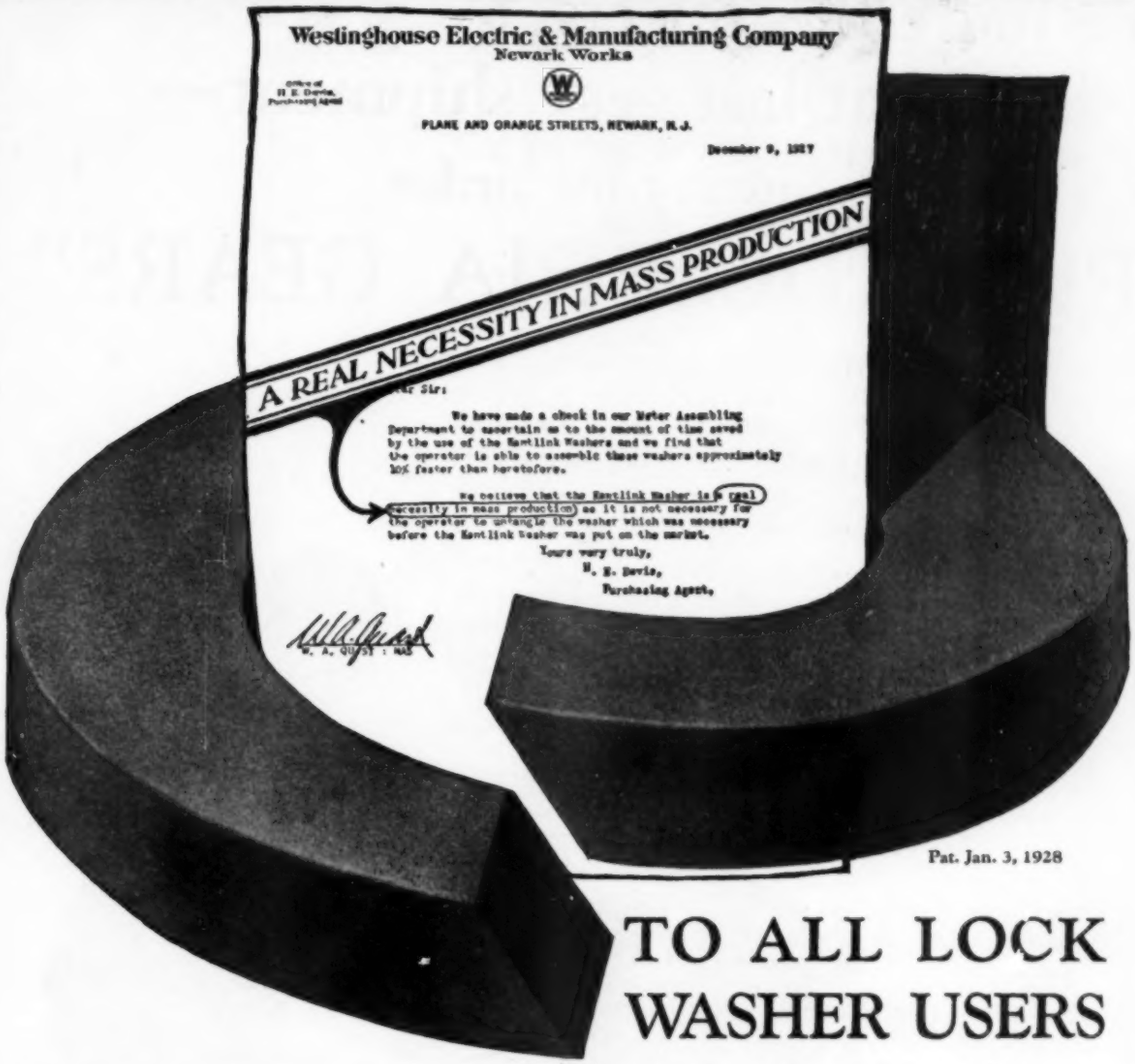
REMEMBER—July 18th is the issue date of the

Semi-Annual

SHOP EQUIPMENT REVIEW and CATALOG NUMBER

The reference number of AMERICAN MACHINIST

ABP ABC


Westinghouse Electric & Manufacturing Company
Newark Works
PLANE AND ORANGE STREETS, NEWARK, N.J.
December 9, 1927
A REAL NECESSITY IN MASS PRODUCTION
We have made a check in our Meter Assembling Department to ascertain as to the amount of time saved by the use of the Kantlink Washers and we find that the operator is able to assemble these washers approximately 10% faster than heretofore.
We believe that the Kantlink Washer is a real necessity in mass production as it is not necessary for the operator to untangle the washer which was necessary before the Kantlink Washer was put on the market.
Yours very truly,
H. E. Davis,
Purchasing Agent.
Pat. Jan. 3, 1928

TO ALL LOCK WASHER USERS

Westinghouse made tests—read what they say.

"We have made a check in our Meter Assembling Department to ascertain as to the amount of time saved by the use of the Kantlink Washers and we find that the operator is able to assemble these washers approximately 10% faster than heretofore.

"We believe that the Kantlink Washer is a real necessity in mass productions, as it is not necessary for the operator to untangle the washer which was necessary before the Kantlink Washer was put on the market."

You can save money also.

Many manufacturers save enough time by using Kantlinks to more than pay their entire lock washer cost.

Kantlinks do not tangle—they do not rust—and they have greater holding power.

Let us send you a trial order for a test in your own plant. Write today to any one of the manufacturers listed below.

Made and sold under license by the Kantlink Manufacturers:

The American Nut & Bolt Fastener Co.
Pittsburgh, Pennsylvania

The Mansfield Lock Washer Co.
Mansfield, Ohio

The National Lock Washer Co.
Newark, New Jersey

The Positive Lock Washer Co.
Newark, New Jersey

The Reliance Manufacturing Co.
Massillon, Ohio

2012-3008

KANTLINK TRADE MARK SPRING LOCK WASHERS
DO NOT TANGLE DO NOT RUST

THEY PAY THEIR ENTIRE COST IN TIME SAVED - SOMETIMES EVEN MORE

"We had 20% rejects in that last gear shipment— next time order PHILADELPHIA GEARS"

There speaks experience! They who've learned in THAT school know that PHILADELPHIA GEARS are not only delivered WHEN PROMISED but are 100% inspected in production. THAT means "no rejects." It means perfect gears, whether the order is for 100 or 10,000. Into their production we put the net result of 50 years' experience in the gear field, PLUS the most modern exclusively gear plant in America. Frequently we cut days or weeks from production schedules. ALWAYS your Philadelphia Gears are 100% perfect—the biggest economy in the long run.

And rush orders

for "gear breakdown jobs"—practically "overnight production"—remember, we're still at it!! Write for the Gear Book.

PHILLIE GEAR

Power Saving Products

GEARS, Spur, Worm, Herringbone, Internal, Bevel, Miter, Intermittent, Spiral, Helical.

NON-METALLIC PINIONS: Fabroil, Textolite, Rawhide.

Whitney Silent and Roller Chains, Sprockets, Flexible Couplings, Universal Joints, Racks, Ratchets and Pawls, and a complete line of gear driven

SPEED REDUCING UNITS

AGMA

Main Office and Plant Erie Ave. and G St. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Offices

New York, 12 E. 41st Street Pittsburgh, Pa., Farmer's Bank Bldg.

One of several standard Cleveland Worm Gear Reduction Units in rubber reclaiming plant

We haven't been in business long enough!

Frequently, the question is asked, "How long will a Cleveland Unit last?"

Judging from the operation of hundreds of *Cleveland* drives which have been running ten years and more, the actual life of a *Cleveland* drive could be put at almost any figure, for these long-used drives show practically no deterioration whatever.

Statements from many satisfied *Cleveland* users indicate they expect at least ten years' service *before any repairs are needed.* But we cannot tell what the ultimate life of a Cleveland unit will be—we haven't been in business long enough, though the first Cleveland Unit was placed in service fifteen years ago. And *Clevelands* were the first efficient worm gear reduction units built for the industrial field.

Long life, together with complete freedom from break-down delays, from costly maintenance charges and from constant inspection are the result of specialization in one product only—Cleveland Worm Gear Reduction Units.

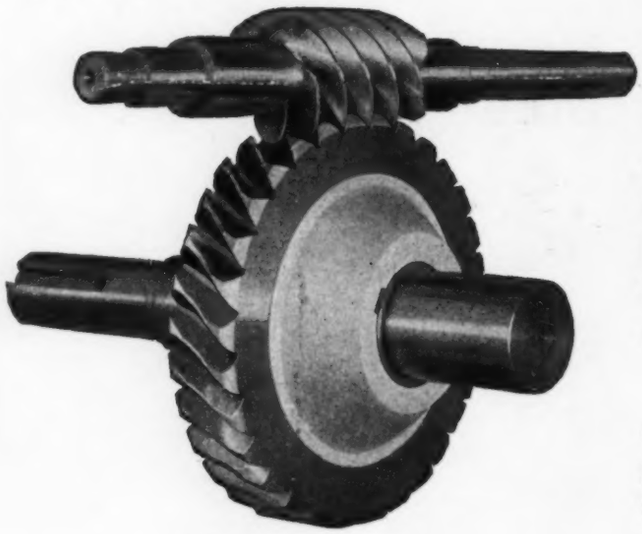
Bulletin 106-A, which will be sent to you without charge, details the construction methods that make *Cleveland* the profitable investment in speed reducers today.

CLEVELAND
WORM & GEAR COMPANY

3254 East 80th Street *Cleveland, Ohio*

"CLEVELAND WORM GEARING THE ULTIMATE DRIVE"

DRIVE IT WITH GEARS



WORM GEARS

You can incorporate in your own machines the same high class worm gearing which has contributed so much to the high position the Horsburgh & Scott Worm Gear Speed Reducers hold in industry today.

We manufacture a complete line of enclosed gear drives and industrial gears, including Sykes type continuous tooth herringbone gears.

The Horsburgh & Scott Co.

5114 Hamilton Avenue — *"Gear makers since '89"* — Cleveland, U. S. A.

Gears for Every Industrial Purpose—Worm—Bevel—Herringbone—Spur—Spiral—Hardened Heat Treated Gears—Non-Metallic Gears and Pinions

Spur, WORM BEVEL *and* MITRE *Gears*

These are some of the types of gears you can get from Jones—cut or molded—in cast iron or steel. Also bakelite gears and rawhide pinions. Specialized equipment to give you specialized service. Our Gear Catalogue gives much practical gear information in conveniently usable form. We will gladly send you a copy.

W. A. JONES FOUNDRY & MACHINE COMPANY
Main Office and Works: 4404 W. Roosevelt Rd., Chicago, Ill.
Branch Sales and Engineering Offices: New York, Cleveland, Milwaukee, Pittsburgh, Buffalo, Detroit, Birmingham, St. Louis, Cincinnati, Kansas City, Mo., Los Angeles, San Francisco.

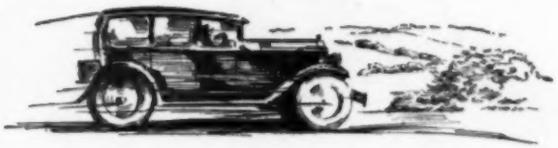
Jones Industrial Gears

Spur Gear

They order

HARTFORD GEARS

By Motor Car—

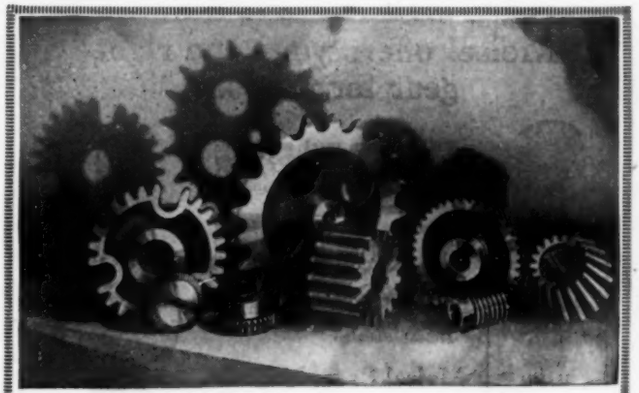


Manufacturers requiring special "Cut to Order" Gears, Worms, Racks or Cams in quantities motor to Hartford to settle on deliveries. Being Hartford Gear Users, they know full well that minutes are not wasted by men or machines in the Hartford plant, but in special cases special plans must be arranged. Those who order Hartford Gears in quantity bear out our claims for highest quality, closest accuracy.

A trial order will prove that dependability is inherent in every Hartford Gear, that delivery dates are religiously observed.

THE HARTFORD SPECIAL MACHINERY CO.
282 HOMESTEAD AVE. HARTFORD, CONN.

Spur Gears
Cam Cutting — Worm Wheels
Bevel Gears — Thread Milling



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Grant engineering ability, workmanship, and prompt service,—factors well worth your consideration in specifying standard or special cut gears.

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Gears up to 12 in. in bronze, up to 36 in. in cast iron. Worms hardened with teeth ground. In stock for *immediate delivery.*

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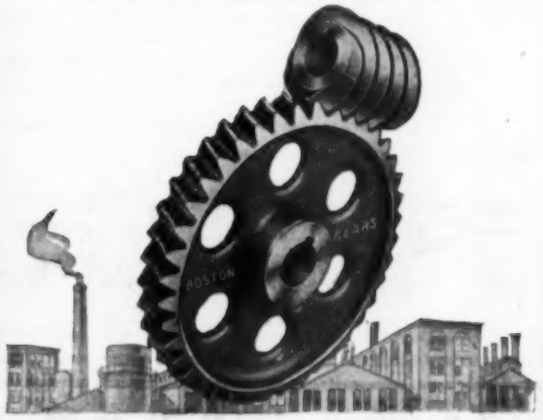

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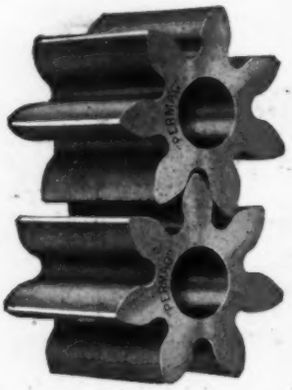

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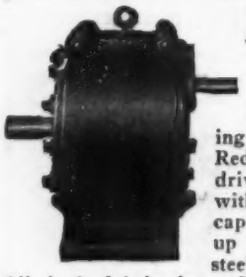

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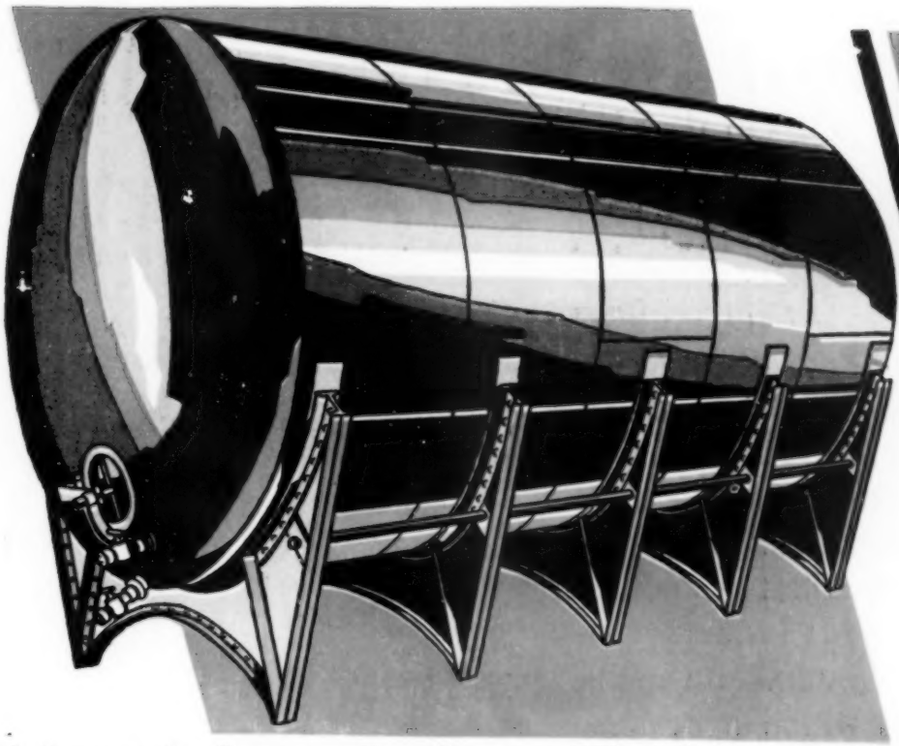

Fashioned from Enduro Nirosta KA2 to Withstand Stain and Acid Corrosion

THE huge container pictured above was made of Enduro Nirosta KA2—for permanence.

This new alloy of nickel, chromium and iron, is far more durable, more satisfactory in every way than straight iron—chromium alloys. Enduro resists rust and corrosion and is not attacked by most acids. It possesses great strength and ductility, is not affected by intense heat and retains a beautiful, polished surface indefinitely.

Developed by Krupp in Germany, this remarkable new steel is now being manufactured by the three American companies listed below for the American market. And everywhere—in all industry—manufacturers are turning to Enduro to better their products.

Metallurgists of any one of the companies below will be glad to discuss Enduro with you—and the possibilities of applying it to your product.

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NIROSTA
KA2 STEEL

CENTRAL ALLOY STEEL CORP.
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ENDURO NIROSTA KA2 fills an enormous gap in industry as a whole. Answering as it does, the long felt need for a non-corrosive steel, resistant to rust, heat and most acids. A material that will not tarnish or lose its luster . . . and cannot contaminate materials with which it comes in contact.

Enduro—with its many practical uses makes possible achievements never before dreamed of.

The story of this new alloy, developed by metallurgists in Germany, and the many ways in which you may successfully apply it to your business, are interestingly told in the booklet shown on the right. Write for your copy today.

The resistance of Enduro KA2 to many chemicals and reagents is indicated by the following condensed table:

	Temperature Degrees C	Loss in Grams Per Hour Per Square Meter KA2
1.5% Sulphurous acid	20	.00
.05% Hydrochloric acid	Boiling	1.79
Potassium Hypochlorite	20	.01
Potassium Hypochlorite	105	.53
Sodium Hydroxide, 20% Solution	110	.02
Sodium Hydroxide, 34% Solution	100	.00
Sodium Hydroxide	318	.22
Potassium Hydroxide, 27% Solution	Boiling	.00
Potassium Hydroxide, 50% Solution	Boiling	.40

Rate of attack will change slightly with variations in operating conditions.

Note that the above applies to Enduro KA2 only, and not to other alloys of similar composition which have not been processed in accordance with the Krupp Nirosta patents.

Enduro Nirosta KA2 Available in
Plates · Sheets · Bars · Strips · Forging Blanks · Shapes · Seamless Pipe and Tubing · Welding Rods · Castings · Wire

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LUDLUM STEEL CO.
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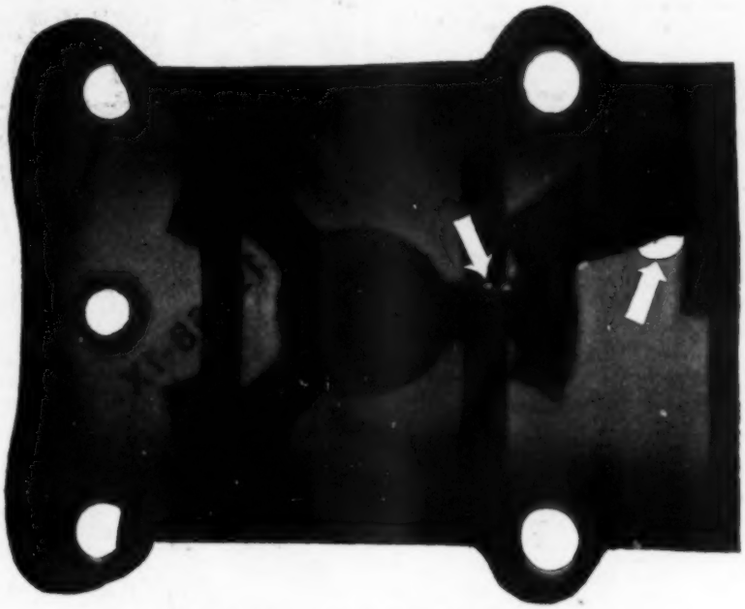
THE BABCOCK & WILCOX TUBE CO.
85 Liberty St., New York, N. Y.



X-raying this part found the flaws marked by the arrows

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How can you be sure that large, special castings for high pressure applications, or for use at high speeds are safe?

Aside from the established testing methods, the efficiency of most of which is problematical, the solution has been to use so *much* metal that even though flaws were in the part it would *still* be safe.

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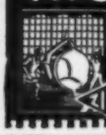

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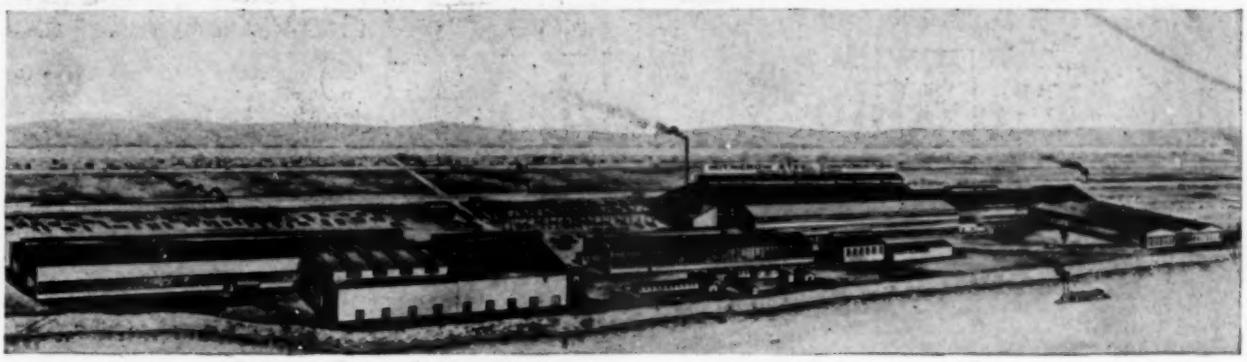

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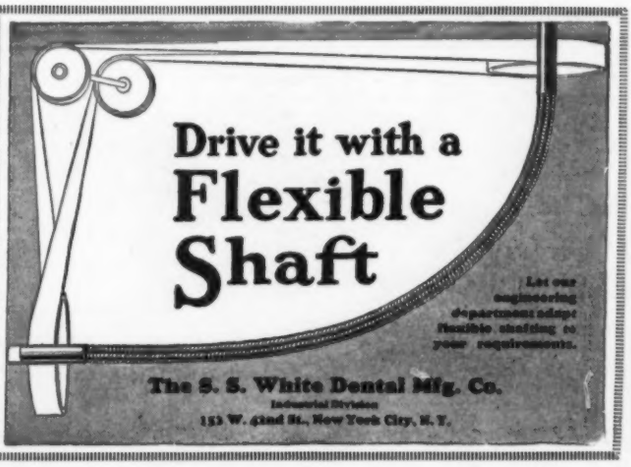

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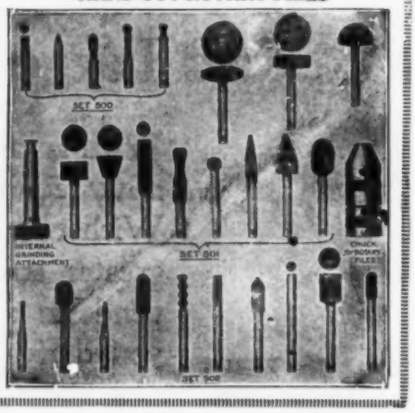

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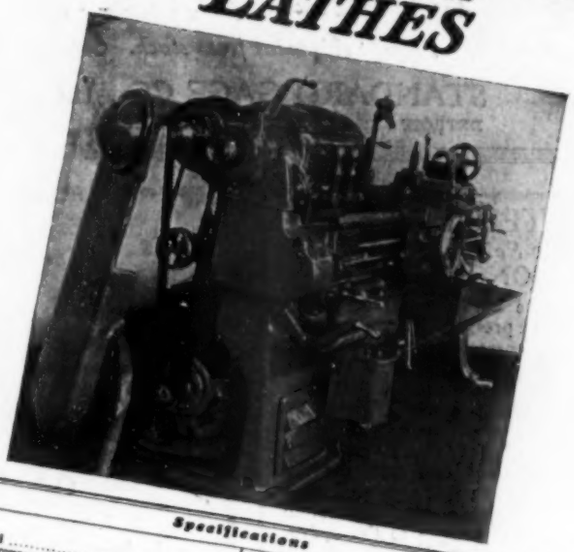

Specifications

Range:	
Swing over bed	16½"
Swing over compound rest	11"
Takes between centers, 6' bed, tailstock flush	31½"
Steady rest capacity	¾"
Tool post takes tool	⅝"x1¼"
Headstock Spindle:	
Front bearings	Precision Timken
Rear bearings	Precision Timken
Hole through spindle	1⅛"
Taper hole in spindle Morse taper (#4 center)	#5
Spindle thread, diameter and pitch	3¼"—4P
Tailstock Spindle:	
Diameter	2½"
Taper hole in spindle, Morse taper	#4
Speeds:	
Threads, with Quick Change Gear Mechanism:	
Number	41
Ranges per inch	2—24
Leadscrew, diameter and pitch	1⅛"—4P
Bed:	
Width x depth	13⅜"x10"
Carriage:	
Bearing on ways of bed	25½"
Cross feed screw, diameter and pitch, Acme	⅝"—5P
Width x depth	6¾"x3"
Floor Space:	
6' bed, length x width x height	7'x3'x6'
Weights:	

EXTREME simplicity marks the new Reed-Prentice line of lathes—for example, only 9 gears are used for 8 spindle speeds in the headstock.

And, befitting such simplicity, this line is furnished with G-E "built-in" motor and controller—an arrangement that gives compactness, refinement, accuracy, and many other advantages essential to efficient, economical production.

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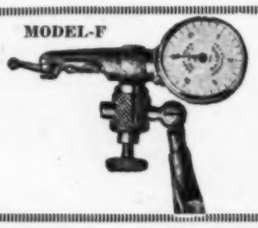

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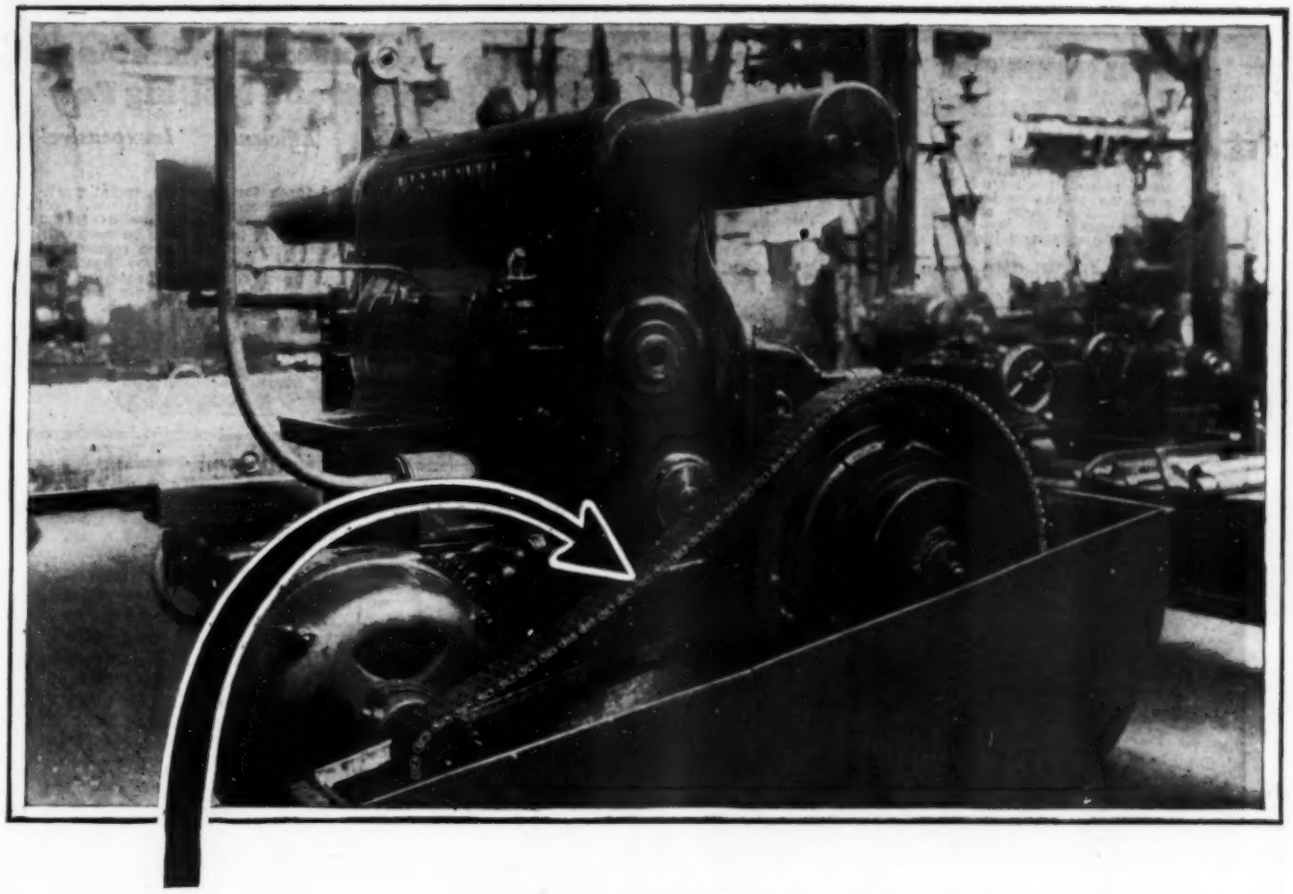

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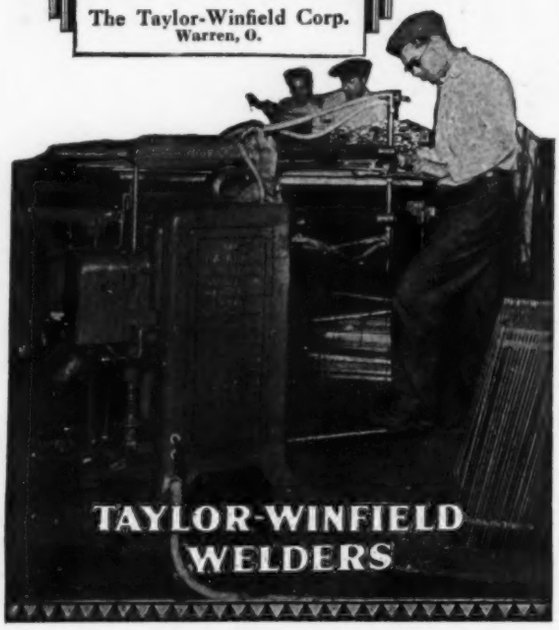

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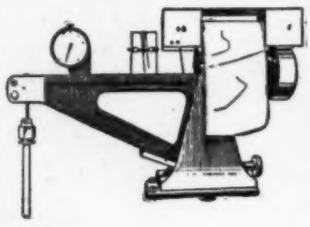

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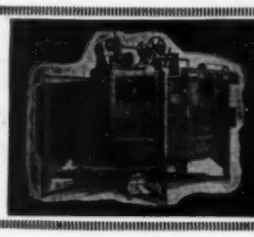

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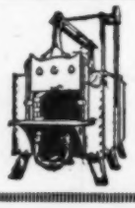

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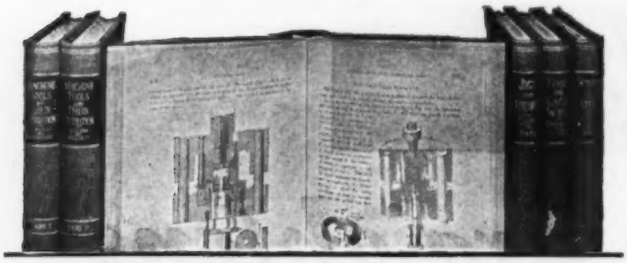

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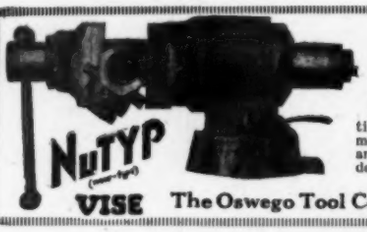

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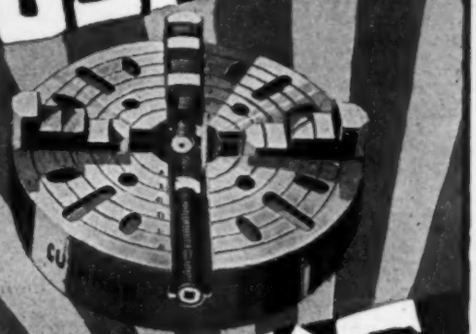

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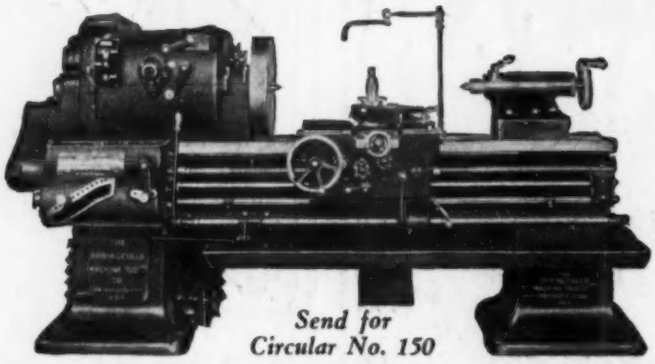

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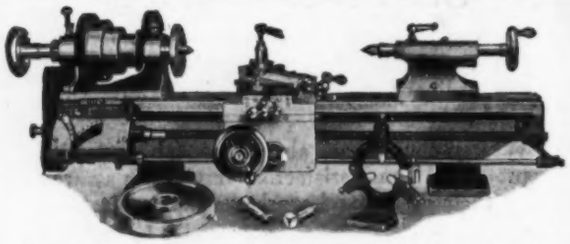

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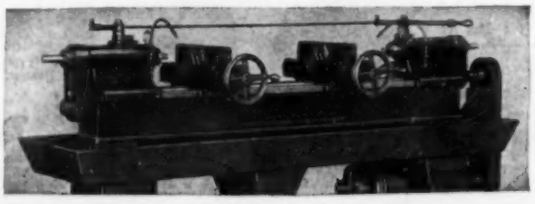

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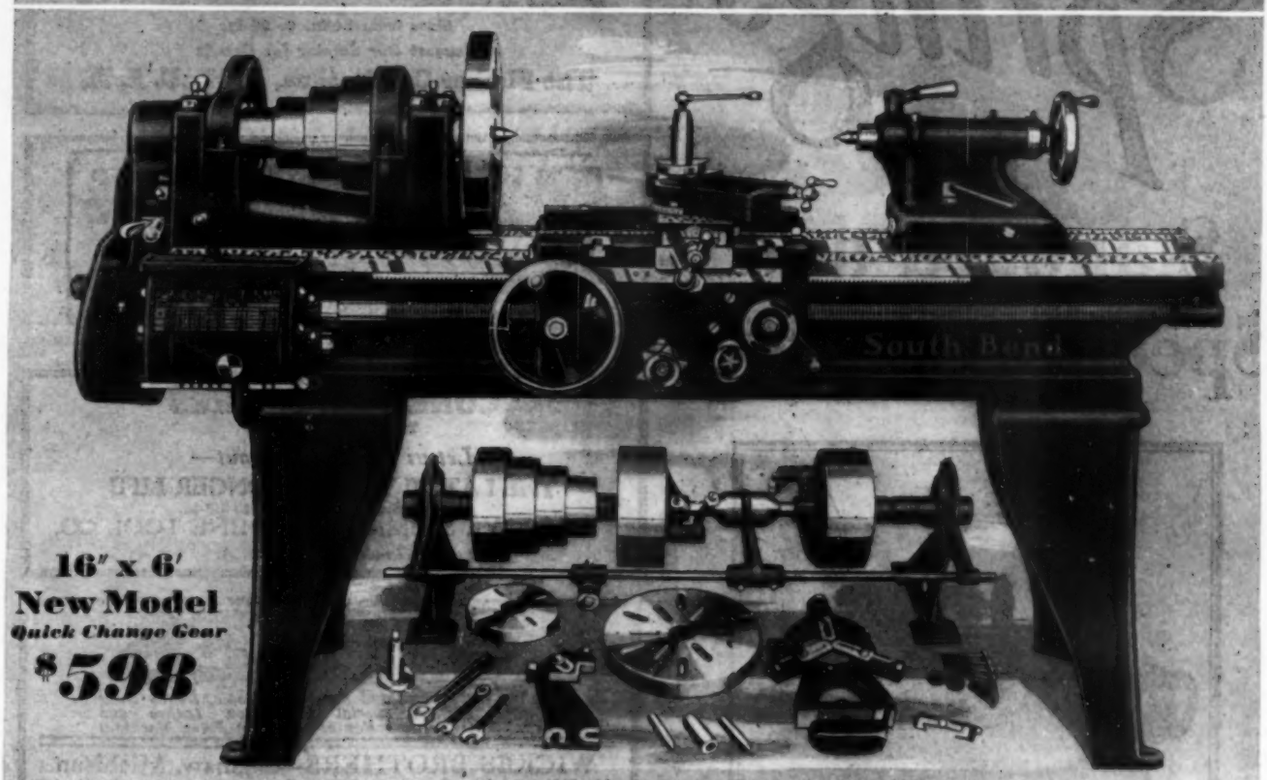

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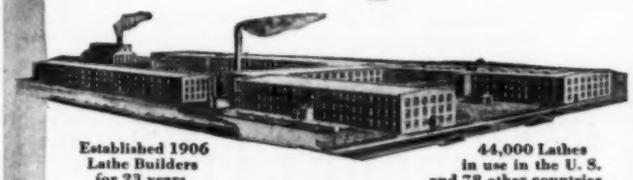

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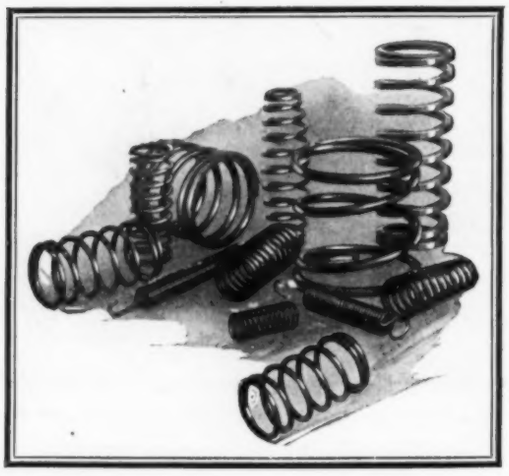

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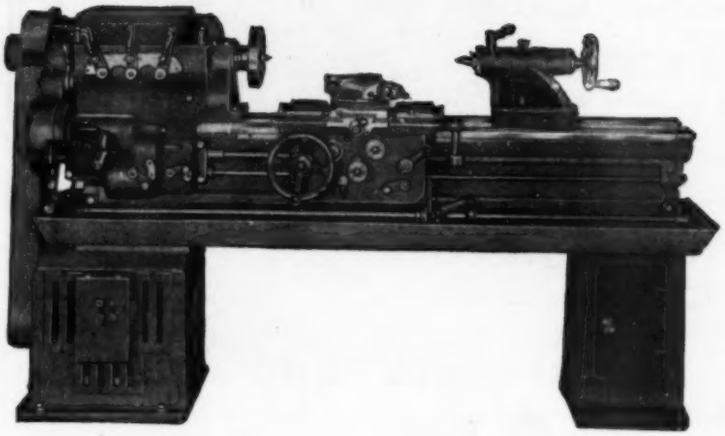

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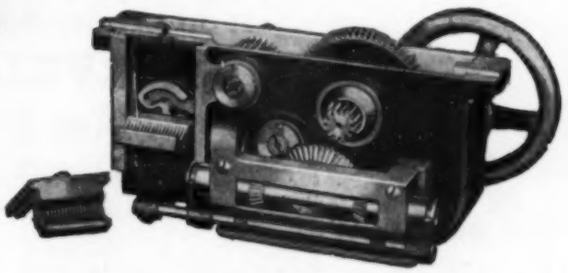

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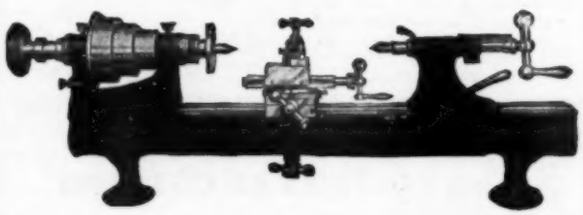

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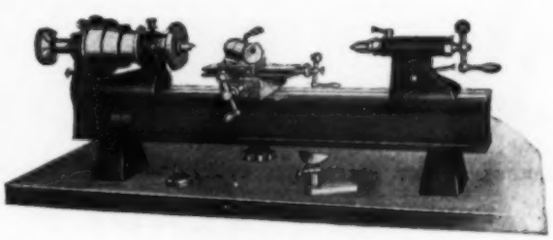

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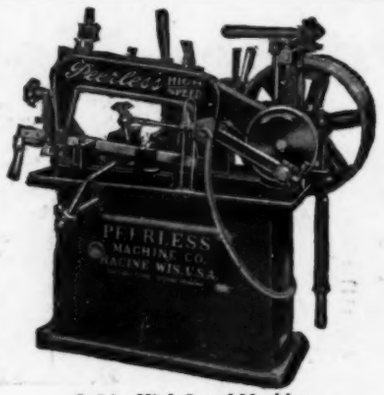

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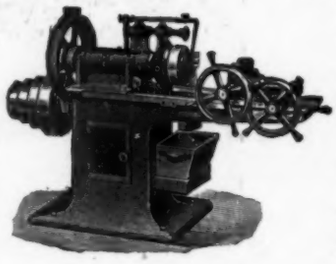

help to give Acme Bolt and Nut Machines their undoubted superiority as immediate cost reducers on all work in their capacity.

They turn out work faster than others and perfect accuracy can be depended upon. Write us for description of our entire line. Catalog?

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Set these packs of Lenox Wolves on the trail of your toughest jobs!

Thousands of shops the country over—shops whose work demands of hack saw blades the very finest quality that money can buy—have turned to these packs of rangy, rugged, super-strong Wolves of Lenox.

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All Hard Tungsten Alloy steel blade is a prime favorite among skilled mechanics everywhere

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Mil Flex—a tough, fast cutting flexible back blade for sawing in awkward places on intricate work

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There are Racine Machines for every metal cutting job.

The Shear Cut for Production Work.
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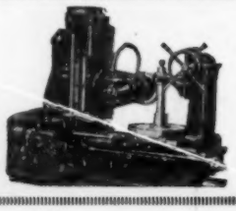

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GEAR HOBBERS
are establishing new standards of gear perfection.

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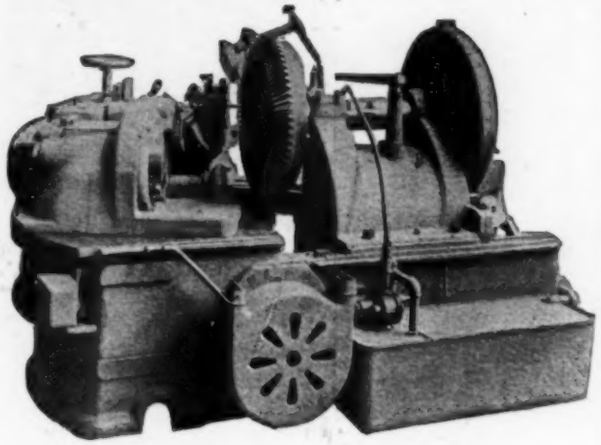

The Gleason 37" Straight Bevel Gear Planer

Gear Planers for cutting the teeth of Straight Tooth Bevel Gears are built in various sizes from 24 to 192 inches by the Gleason Works. They are designed primarily for jobbing or repair work, and economically cut one or several gears at a set-up.

The tooth contour is copied from a template, making possible a large number of tooth shapes. The tools are simple in design, being similar to ordinary planer tools.

The planer illustrated has a capacity for mitre gears up to 37 inch pitch diameter and will cut a 48 inch gear with a cone distance not exceeding 26 inches.

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Up to 32-in. O.D. cut Theoretically correct. SPECIAL facilities for CUTTING, in any MATERIAL. SPUR, MITRE, WORM, HELICAL, INTERNAL, ELLIPTICAL GEAR WHEELS, SKEW (Hypoid) BEVEL GEARS.

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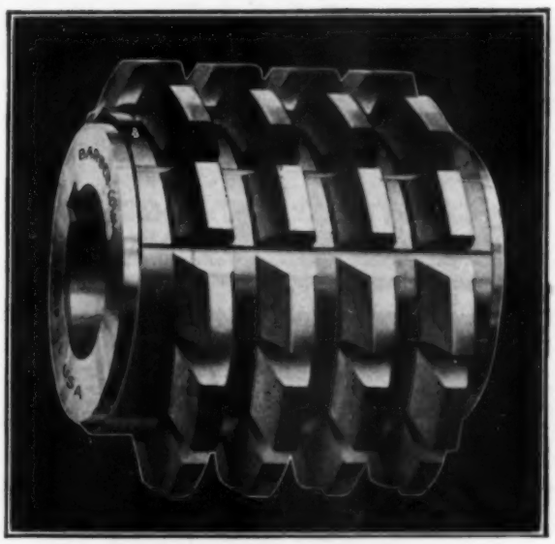

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No discoloration or oxidation occurs. Threads and edges are not damaged by its action.

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1% of this powerful disinfectant stops all cutting oil infections

Sylpho Nathol is powerful but harmless—one of the few germicides that are active in oil. Positively kills all bacteria that cause boils, pus-forming sores, follicle rash, and such infections.

Many prominent concerns use this germicide to prevent loss of time and interrupted production resulting from infections.

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All sizes from 1/64-in. to 1-in.

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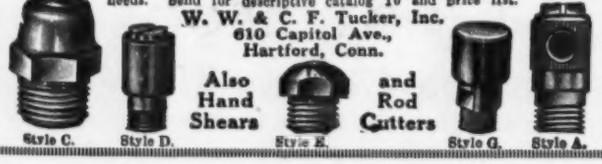

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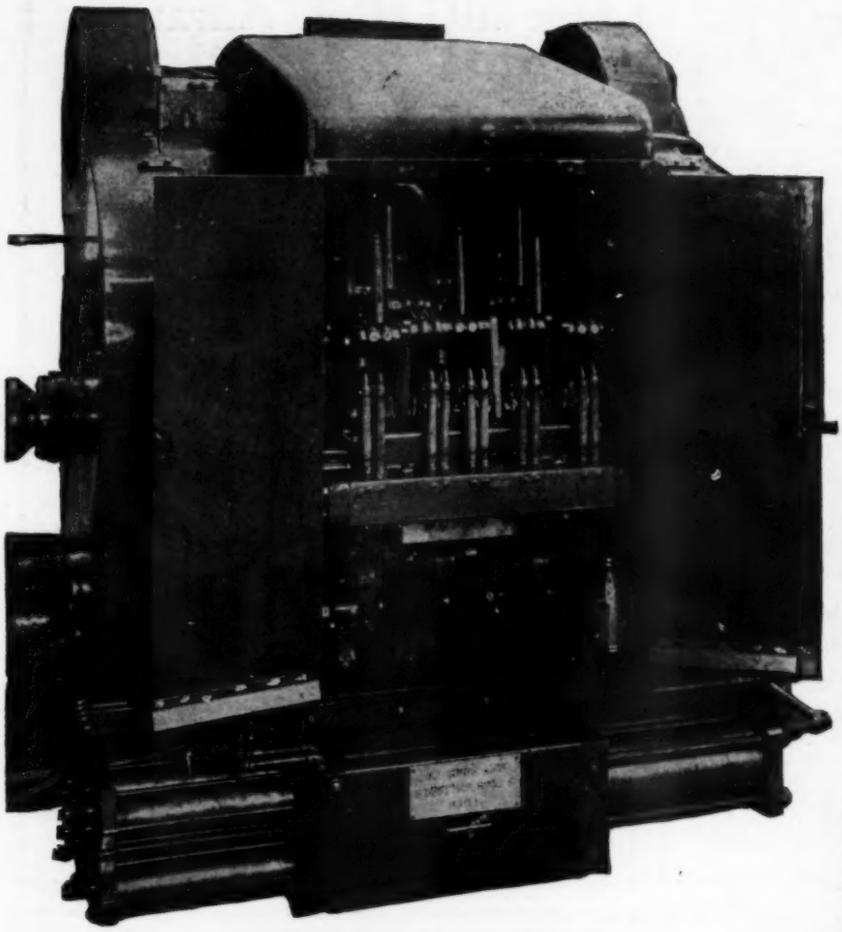

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CLEAN OIL Aids HIGH ACCURACY

DUST laden, grit filled oil is probably the greatest enemy of accuracy in machine tool output.

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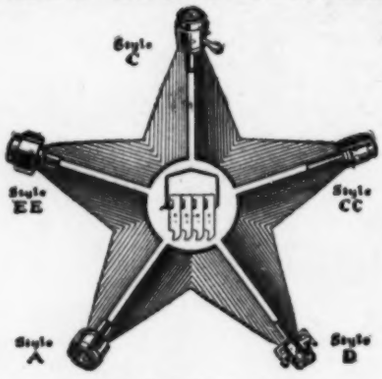

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Use this ONE set of Chasers

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Automatically Oiled Die-Sets

ONE OF OUR MANY STYLES AND SIZES

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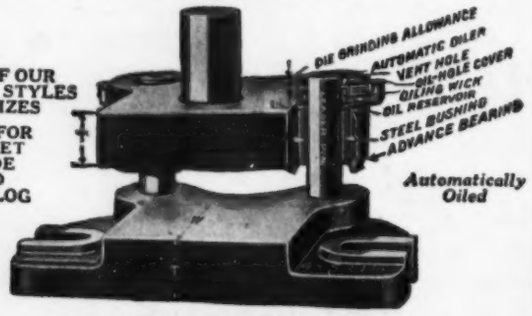

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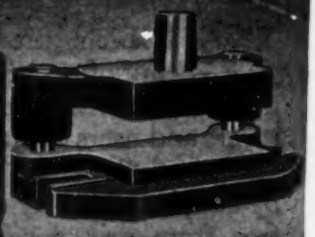

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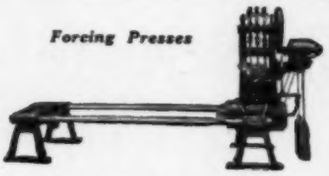

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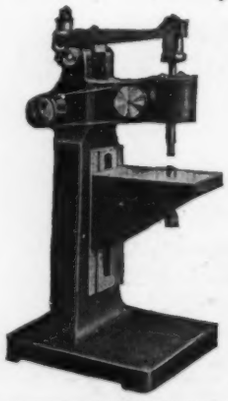

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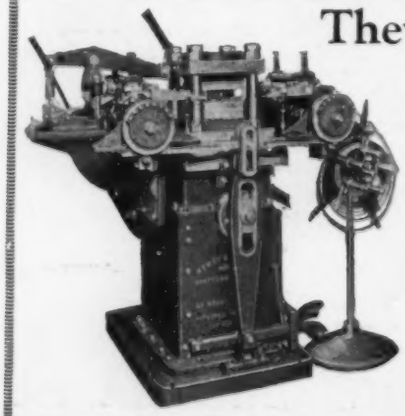
They never fail



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will handle the most difficult work, built to take from ¼ in. up to 4½ in. capacity.

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The machine weighs less than 100 lbs.

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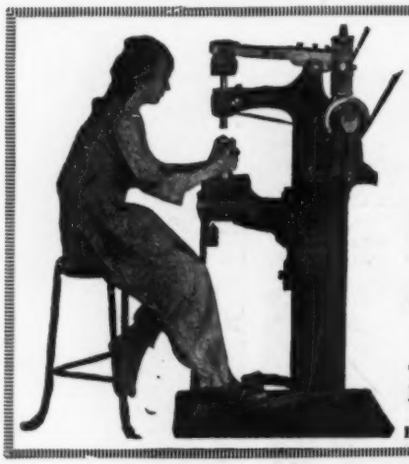

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Cold Riveting 1/64 in. to 1½ in. in diameter

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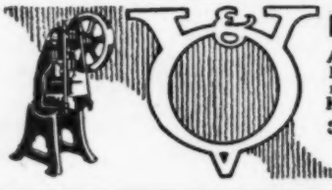

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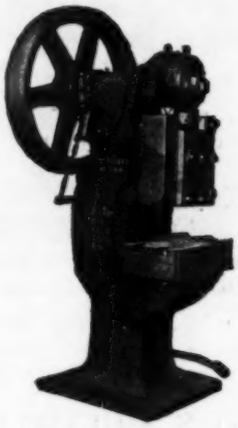

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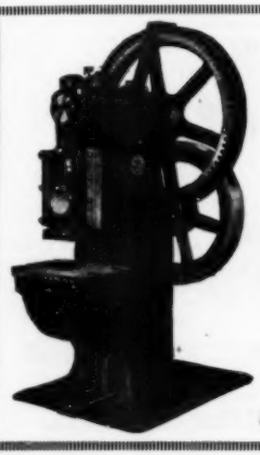

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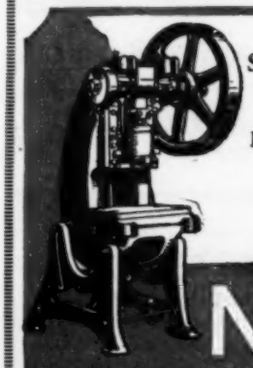

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Also complete line of shop machines and tools. *Write.*

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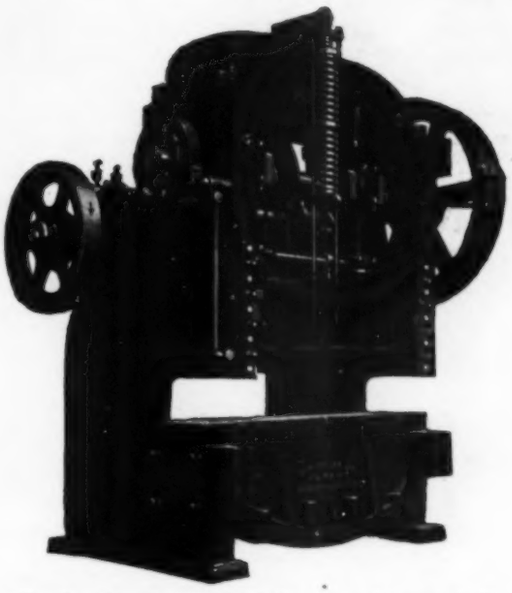
Wherever sheet metal parts are made



Bliss Gap Frame Double Crank Presses as shown are built in a great variety of sizes and widths, weights vary from 4,000 lbs. to 280,000 lbs. There is a size and width to meet every requirement.

A complete list of articles being made with Bliss equipment is a revelation of the surprising extent to which sheet metal parts are being used in every industry. Jewelry, household utensils and appliances, hardware, electrical apparatus, automobile, tractor and car parts, metal furniture—it is difficult to find any metal product that does not include some sheet metal part.

One of the reasons for the wide use of sheet metal parts is their combined strength and lightness. Another is the high degree of speed, accuracy, ease, and economy with which they can be made, and these advantages have been established largely through the work done by Bliss Presses.

Let us explain the application of Bliss equipment to *your* sheet metal operations. The 70-year experience of the Bliss engineers is sure to be helpful to you.

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are best for general purpose production on small hole drilling jobs. The work is clamped automatically and can be burred automatically if desired. The spindle is advanced under a resilient pressure feed with friction control which varies the rate of penetration automatically to meet the variable conditions encountered as though under human control. The result is an extra high drilling speed with a big saving in drill breakage.

KINGSBURY MACHINE TOOL CORP.
Originators of Automatic Drill Head Unit
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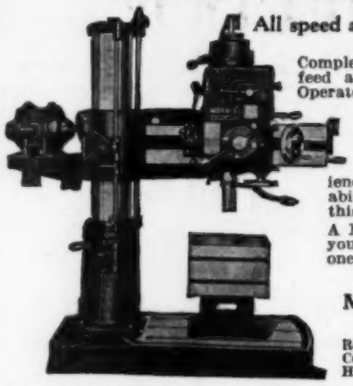

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Tri-Way Type

For Close Accuracy, and Large Production

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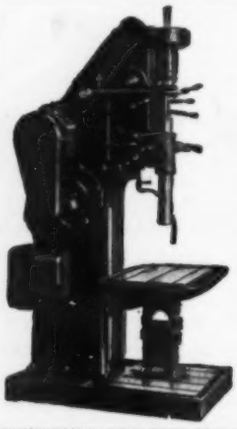

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Increased Production from 80 to 600 per hour, Aluminum Carburetor Bodies having six No. 10-32 holes each

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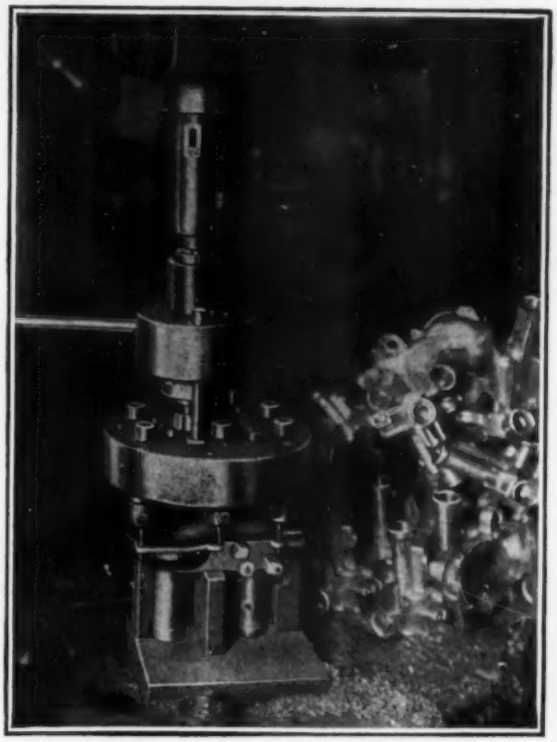

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Send for Production Estimates
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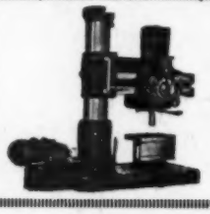

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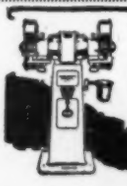

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DIAMOND FLOOR GRINDER
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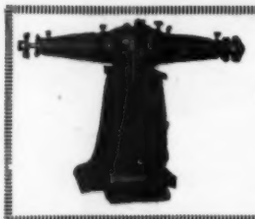

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Manufacturers of Grinders, Buffers, Speed Lathes and Manual Training Lathes.
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Either Horizontal or Vertical Spindle Type
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PRONOUNCED
MARSH-KEY
GRINDERS AND BUFFERS
PRODUCT OF BLACK & DECKER

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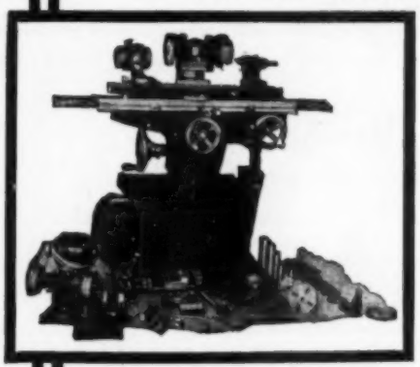

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Made in Five Sizes

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increases production and eliminates spoiled work through its simple semi-automatic operation whereby all controls are operated through one lever. Equally at home on Toolroom or Production work.

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"BORITE" for grinding steel of all kinds.

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KNEE TYPE—RING WHEEL
for Flat Surfaces
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for Emery Rings, 10 in. to 30 in.

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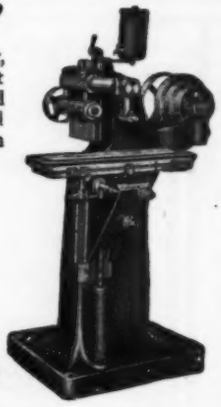
Don't make the mistake of using big, expensive milling machines on light jobs, where the U. S. Improved Hand and Weight Feed Milling Machine will give you greater and better production at infinitely lower cost.

Don't! it isn't logical. Bulletins on request.



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MILLING MACHINE

The United States Machine Tool Company
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SPLINE MILLERS
for closed end keyways and through slots.

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with circular, contour, spiral and continuous milling attachments.

DRILLING MACHINES
1 to 7 spindles, hand, power and simultaneous feed. Heads, adjustable for variable distances between spindles.

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Uniform blow, foot or power.

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All of our skill and experience in the cutting of cams is at your command through the services of our contract department.

If your cam requirements do not warrant the purchase of a specialized Rowbottom cam cutting machine you may still insure Rowbottom Standards by having us make your cams for you. We will be glad to quote from specifications.

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For screw machine economy, accuracy and big output

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The **GIANT** Keyseater will be found to be, not only a most accurate, but also a quicker and cheaper way of cutting all types of keyways, straight or taper.

It is certainly worth investigation. ***Write us for details.***

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DRILLING Machines of all types—Gang Drills, Sensitive Drills, Sliding and Stationary Head Drills, Horizontal Drilling, Boring and Tapping Machines, Multi-Spindle Auxiliary Drilling Heads, etc.

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Plain Cylindrical, Universal and Valve Seat Grinding Machines.

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A Product of Corning Glass Works
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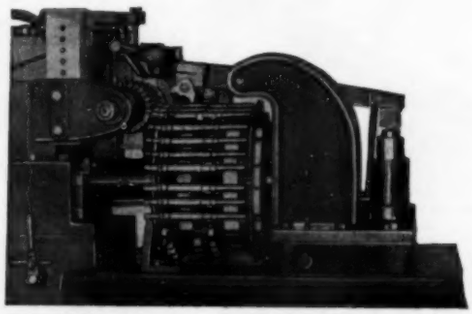
Long pieces are handled easily with this type of fixture—

The PRODUCTO-MATIC

Eight-station Fixture Indexing in a Horizontal Plane



Work fixtures can be designed to index in all *three* planes. This frequently permits the handling of long work such as automobile axles, etc. This 8 station fixture indexes on a horizontal spindle and four shafts are straddle milled simultaneously. Clamping and ejection also automatically performed. Output 725 pieces per hour.

SLITTING keyways or squaring ends of automobile and tractor axles is representative of the type of *long work* that can be accommodated by this in the PRODUCTO-MATIC.

Since the whole cutter spindle mounting can be moved up, down or forward, tapered and profile work can be readily accommodated.

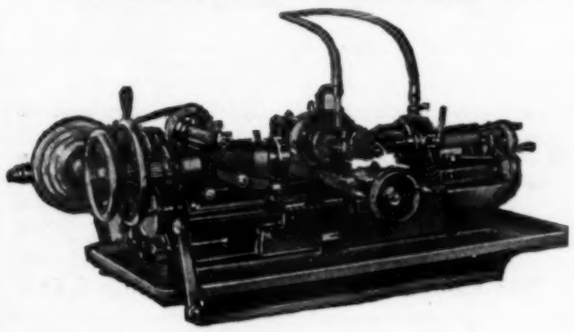
Naturally, the cutter feed-in, cam operated to eliminate lost time in conjunction with the indexing of the fixture, insure maximum production at all times.

It is a hard matter to define the field for PRODUCTO-MATIC Millers. Practically all classes of milling operations can be done. The parts can be made of castings, forgings, stampings, bars or tubes. Fixtures can be designed to hold any shape. Milling operations such as squaring, hexing or octagon straddle-milling, slabbing, grooving, keywaying, cross-milling, etc.

Versatility is another important feature—an endless number of jobs can be handled by merely switching holding fixtures—an invaluable feature for the smaller shops where short runs of varied work is the rule.

The Producto Machine Company,
Bridgeport, Conn.

WALTHAM SEMI-AUTOMATIC THREAD MILLERS



For the Production of Small Parts in Quantities

Waltham Semi-Automatic Thread Millers were specifically designed for just that.

That they are keeping production costs on small threaded parts down to rockbottom is proved by some of the records they have established and maintained on all sorts of work within their range.

Technical details gladly sent on request.

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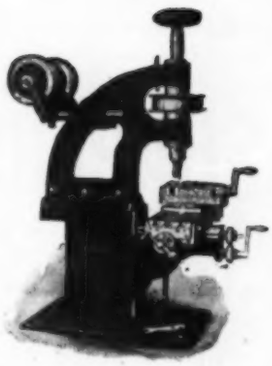
HIGH ST., WALTHAM, MASS.

Foreign Representatives: Buck & Hickman, Ltd., London; Fenwick Freres Co., Paris; Andrews & George Co., Tokyo, Japan; Andrews & George Co., Seoul, Korea; Andrews & George Co., Dairen, Manchuria.

Cataract Precision Lathes & Millers

Cataract Vertical Miller

If it's a milling job of high precision, it's a Cataract Miller Job. Table feed is automatic, with travel of 5½ inches. All feed screws are provided with independent micrometer dial indexes with graduations of .001.



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HARDINGE BROTHERS, Inc.
4149 Ravenswood Ave., CHICAGO, ILLINOIS

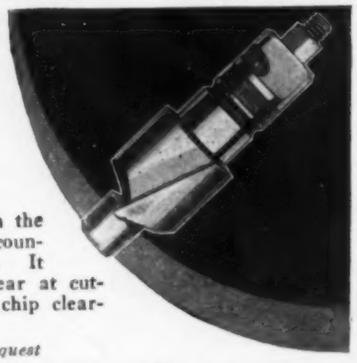
AMPCO

HIGH SPEED TWIST DRILLS AND REAMERS

INCREASING numbers of Tool Superintendents and Production Managers are finding Ampco's specialized production of high speed steel tools a real aid in meeting the demands of intensive production schedules. Standard and special tools made to specification are illustrated in Catalog No. 6. Send for your copy.

AMPCO TWIST DRILL CO., Jackson, Mich.
Branches in all principal cities—see telephone directories

TWO-LIPPED HOGGING CUTTER



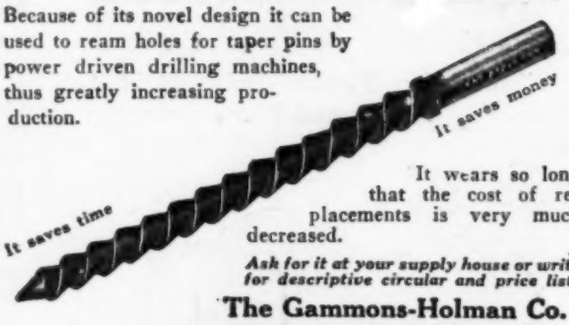
This specially designed tool (which will fit any standard Eclipse holder) will cut through hard or sandy scale instantly, that would turn the edges of the ordinary counterbore or spot facer. It features a generous shear at cutting points and ample chip clearance.

Catalogue Upon Request

ECLIPSE INTERCHANGEABLE COUNTERBORE **COMPANY**
DETROIT ~ MICHIGAN

The Gammons Taper Pin Reamer

Because of its novel design it can be used to ream holes for taper pins by power driven drilling machines, thus greatly increasing production.



It wears so long that the cost of replacements is very much decreased.

Ask for it at your supply house or write for descriptive circular and price list.

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Twist Drills, Reamers — Screw Extractors

See our Page advertisement, June 6, issue

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The CLEVELAND TWIST DRILL COMPANY CLEVELAND

Twist Drills, Reamers Milling Cutters, Hobs Special Tools

Use ARMSTRONG Tool Holders

Save
All Forging
70% Grinding
90% Tool Steel

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Reamers
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DAVIS BORING TOOL COMPANY, INC.
Div. Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo.
See full page ad first week of each month.

Production Tools — ERIE TITAN TOOLS PENNA — for Drilling and Tapping

Ask for Catalogue

Titan Tool Co.
Erie, Pa.

CAD-AD

Cincinnati Shapers
Rapid Traverse

Write
The Cincinnati Shaper Co., Cincinnati, O.

SHAPERS simply designed but accurate and efficient

12-in. to 32-in. stroke (inclusive)
THE SMITH & MILLS COMPANY
Cincinnati, Ohio, U. S. A.

CLEVELAND
THE CLEVELAND PLANER COMPANY
3148 SUPERIOR AVE. CLEVELAND O.
OPEN-SIDE

Multi-Spindle CHUCKING MACHINES

GOSS & DE LEEUW

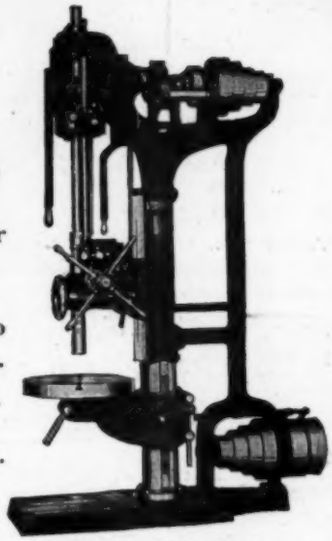
MAKE YOUR CHUCKING PRODUCTION PROFITABLE
For details, see advertisement in May 16 issue.
The Goss & de Leeuw Machine Co., New Britain, Conn.

"LOGAN"
AIR OPERATED DEVICES

For every chucking requirement.
Adaptable to all types of machines.
Send for catalog R-23 for complete details.

THE LOGANSPORT MACHINE CO.
Sixth and Market Sts., Logansport, Ind., U. S. A.

HI-SPEED



25" KOKOMO HI-SPEED
Code: Bush-Tap

What are YOUR requirements?

Send us your blue-prints.

We'll be glad to offer our recommendations.

No obligations.

"—we must have more production or we will be compelled to look elsewhere for a new source of supply."

Possibly your customers are pushing you for MORE production. Will your present equipment stand the strain of continuous driving?

The 25-in. KOKOMO HI-SPEED drilling machine as shown to the left is one of our many machines designed to meet present-day production requirements. Being equipped thruout with hi-grade bronze bushed bearings, you are assured of HI-SPEED production with a minimum loss of time. Performance of this type can have but one ultimate end, more PRODUCTION, which means nothing less than greater PROFITS.

Write today for our complete catalog giving detailed information of our entire line.

SUPERIOR MACHINE TOOL CO.

P.O. Box 376 Since 1902 Kokomo, INDIANA

Anyone can break a Tap in a Hole

but ordinary methods of removal spoil the thread and scrap the job.

We offer you a tool that will remove broken taps quickly and not harm the threads by the operation.

It is stocked for taps from 3/16-in. to 1-1/4-in.—smaller or larger on order.

Learn all about this low cost tool that usually pays for itself in the first job. Send for descriptive bulletin and prices.

Walton Tap Extractors can be furnished for removing either 3 or 4 fluted Taps of any size.

THE WALTON COMPANY
311 Pearl St., Hartford, Connecticut

. . . discriminating mechanics tell us

that they find the same high quality and service-giving features in American Swiss Tools that they have found in American Swiss Files of Precision.

Write for Catalogs

American Swiss File & Tool Co.
410-416 Trumbull St.
Elizabeth, N. J.

American Swiss

files of precision
mechanics' hand tools and knurls

HOOVER

The Product of America's Foremost Ball Plant

BALLS

BALL BEARINGS
(annular and thrust)

ROLLER BEARINGS
(tapered)

Let us figure with you.

HOOVER STEEL BALL COMPANY
Ann Arbor, Michigan
Branches: Chicago, Brooklyn, N. Y., San Francisco.

"Universally Dependable"

QUALITY has merited this slogan for Hartford Metal Balls for Bearings and other purposes.

Right in size, correct in sphericity and uniform in heat treatment. Hartford "Universally Dependable" Balls are made from Carbon Steel, Chrome Alloy Steel, Stainless Steel, Bronze and Monel Metal.

Our Folder gives sizes, prices and descriptions.

THE HARTFORD STEEL BALL CO.
Makers of Steel Balls for Bearings, Burnishing Balls and Materials
609 Franklin Ave., Hartford, Conn.

Send for circular

Ask us about "Bronze to Bronze" Our new Catalog and Price List No. 20 tells all about it.

"BRONZE TO BRONZE"

Dart Unions Guaranteed Tight

Dart Unions have both Bronze rings machined to a true arc or ball joint, and ground with oil and corundum to a perfect fit. They don't need packing, yet positively will not leak.

E. M. Dart Mfg. Co.
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The Fairbanks Co., Sales Agents
Canadian Factory—
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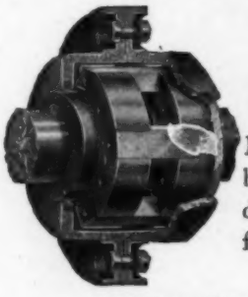
GUARANTEED QUALITY

We stamp the name "BAY STATE" on our Twist Drills as a guarantee of highest quality. We stand squarely back of every shipment as to its performance, service life and size accuracy. The dollars invested in Bay State Drills bring back big dividends. So do those spent for Bay State Taps, Dies and Screw Plates. All are detailed in our Catalog.

BAY STATE TAP & DIE CO.
Mansfield, Mass.

"NICHOLSON" *All Steel— Heat Treated Lubricated*



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No springs or rubber to break and deteriorate. Strong, durable and rugged. Write for Bulletin 329.

W. H. Nicholson & Co.
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—Standardize your threads—
by using one make of threading tools
MURCHEY
Self-Opening Dies and Collapsible Taps
101 Varieties—All Adjustable—Write for Catalog
MURCHEY MACHINE & TOOL CO.

AUBURN BALL BEARINGS

Thrust, Annular, and Special Ball Bearings. Steel, Bronze, Monel Balls.
Write for Data Sheets
AUBURN BALL BEARING CO.
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Right from the Lead

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Casler Offset Boring Heads

Reduce cost of jigs, fixtures and experimental work and reduce cost of manufacturing.

Send for Catalogues.

HERMAN CASLER, Canastota, N. Y.

This 176 page Ball Bearing Manual . . . . . .

FREE to Engineers-Designers-Draftsmen

A Few of the Subjects

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Mountings
Lubrication
Loads and Dimensions

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Covering Fourteen Types of BALL BEARINGS

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Extra Small
Narrow Type
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Radio-Thrust
Thrust Bearings
Clutch Throw-out
Double-Row Radial
Deep Groove Radial
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Double-Row Angular Contact

The Gurney Manual is an "all-purpose" handbook of carefully compiled Ball Bearing information.

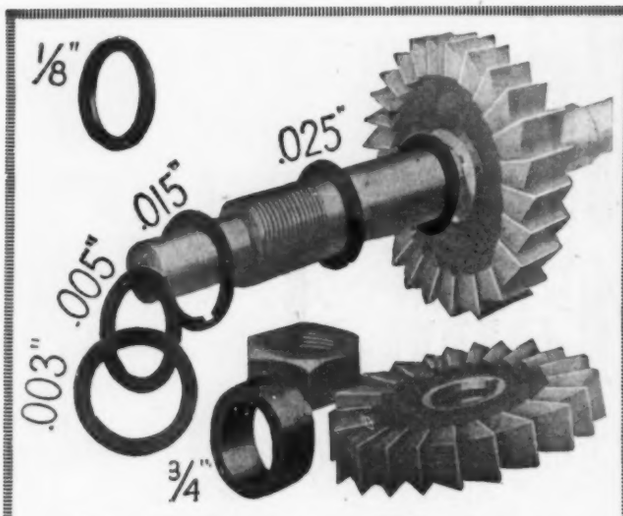
Gurney engineers—many of them pioneers in the anti-friction field—have put their years of extensive shop and field experience into its 176 pages.

Technical men will find that the Gurney Manual fills their need for a single reference book that will supply all necessary information for selecting—mounting—servicing all types of Ball Bearings.

Your name and address by post card or letter will bring one of these manuals without charge.

Gurney Ball Bearing Division
Marlin-Rockwell Corporation
402 Chandler St Jamestown, N. Y.

GURNEY
BALL BEARINGS



Steel Spacing Washers

ARBOR SIZES						STOCK THICKNESSES				
3/8	3/4	1 1/8	1 1/2	1 7/8	2 1/2	.001	.005	.010	.025	.093
1/2	7/8	1 1/4	1 5/8	2	3	.002	.006	.012	.032	.125
5/8	1	1 3/8	1 3/4	2 1/4	3 1/2	.003	.007	.015	.047	
and 4 inches and larger.						.004	.008	.020	.063	

Send today for samples of the sizes you use most. Stock thicknesses for arbors of various diameters are carried in stock, ready for shipment, as shown.

Spacers thicker than 1/8 in. are turned from bar or tubing but not carried in stock.

Prices and samples on request.

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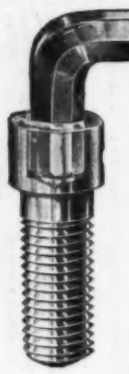
3445-3459 West Fort St., Detroit, Mich.



ALLEN Socket-Head *Cap Screws*

The strongest, handiest screws for punch, die and jig work. Can be set up tighter than hexagon head screws; no corners to round off and allow wrench play. Fine for "close work" where there's no room to use an "S" wrench. No slot to spread as in slotted fillisters. Heads are finished all over and turned true to the body of the screw; can be set up in a counterbored hole without grinding off the sides. Cold drawn by Allen process; scientifically heat-treated. Threads die cut, accurate in pitch, perfect in lead *Ask for circular.*

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UNBRAKO

Sockethead Cap and Hollow Set Screws

"UNBRAKO" Screws are famous for their unusually accurate and clean threads. The **"UNBRAKO"** won't fracture, won't round in the hex, won't mushroom.

A complete line always in stock. Write us for free samples and Form 398.

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Sizes from 5/8-in. to 6-in. carried in stock

Cast Steel PROTECTED Lathe Dogs

A simple, little device that prevents acidents. Any standard open end or socket wrench fits them. Carried in stock for prompt shipment. *Write for prices.*

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BRISTO SET SCREWS

Safety

The perfect grip of the wrench enables Bristos to be set up tight and removed without damage to socket or threads. Write for samples and folder. The Bristol Co., Waterbury, Conn.

X-L-O DRILL JIG BUSHINGS

75% of the X-L-O Drill Jig Bushings sold are priced at 60 cents or less! 2534 standard styles and sizes in stock for immediate shipment. Catalog, data sheets and price list upon request.

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MAC-IT Safety Set Screws will not become distorted with long use

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Leader Pin Bushings
Leader Pins
Expansion Laps
Hardened and Ground Dowel Pins

Send for Data Sheets and Price List.

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Universal Drill Bushings
Eliminate Non-Productive Time by Easy and Speedy REPLACEMENT
Write for Full Information
A Product of
UNIVERSAL ENGINEERING CO.
FRANKENMUTH, MICH.

Pat. Nov. 13, 1928

Introducing NON-LINK POSITIVE

—the Parkerized "Positive" Lock Washer that can't link

AT LAST, a "Positive" Type Lock Washer that can't tangle, can't link and is rust-proof.

It is new in design—not simply a modification of the original Positive Type Lock Washer.

Yet it has all the "positive" gripping features heretofore found exclusively in the Positive Type Washer.

The New NON-LINK POSITIVE Lock Washer with (1) ratchet shaped barbs, (2) spring acting body, (3) non-linking design and (4) rust-proofed surface, is more than a mere spring washer.

It is a quality unit, a part capable of meeting the requirements called for by assemblies of the highest class.

NON-LINK POSITIVE Lock Washers can now be obtained from stock in all standard bolt sizes.

Just send direct for samples and latest discount lists.

Details on "Positive," "Kant-link" and Plain Type Washers also mailed upon request.

For Nearly FORTY YEARS—LOCK WASHERS *Exclusively*

Patented Nov. 13, 1928
NON-LINK POSITIVE

Positive Type

The
POSITIVE
LOCK WASHER CO.
Newark, New Jersey

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KANT-LINK

Plain Type

MAKERS OF ALL TYPES OF SPRING LOCK WASHERS AND NUT LOCKS

"Our boys turn out more pistons in a day, and with each wheel, than ever before" Tour Grinder

About a year ago one of the big Detroit companies, producing aluminum alloy pistons, changed over to resinoid bonded snagging wheels. Today, this company is getting more production from fewer machines, more pistons per wheel life and have effected a twenty per cent cut in the piece work rate.

These new wheels are twenty-four inches by five inches, with a twelve inch hole. Safely run at a speed of 9,000 surface feet per minute, instead of the usual five or six thousand feet, each operator has been averaging about 3,000 pistons per day, and a single wheel is good for almost a half million of these parts.

The open structure of this wheel and the low heat conductivity of the resinoid bond eliminates gumming and disagreeable odors. The wheel stays cool at high speed, and its fast cutting quality makes it easier on the operator. Suitable for almost any type of snagging, these wheels are effecting big savings for many users. Manufacturers will be glad to demonstrate the particular wheel for your job.

Abrasive wheels bonded with resinoids made by Bakelite Corporation are produced by all of the leading manufacturers. Names on request.

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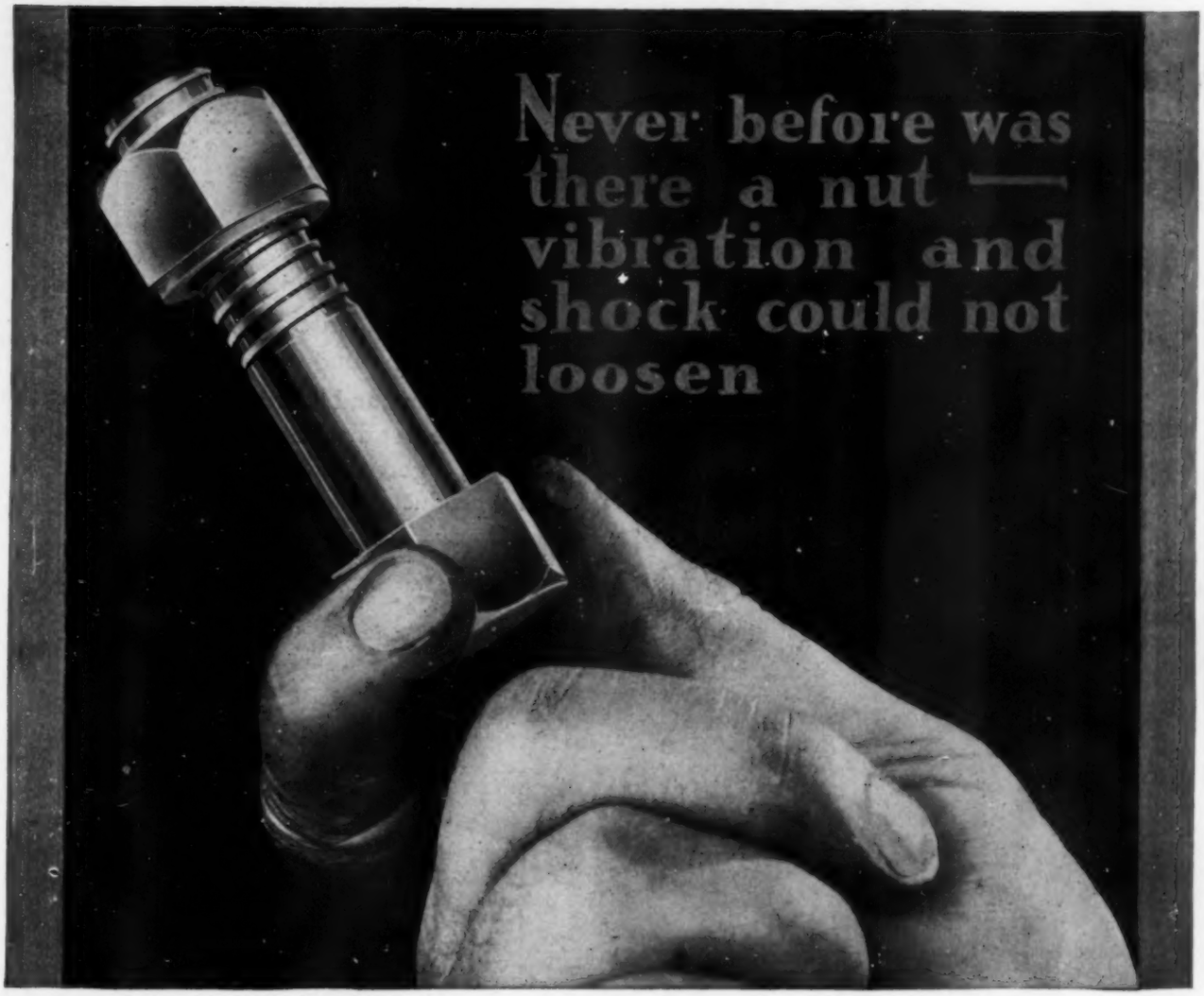
BAKELITE

REGISTERED U. S. PAT. OFF.

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity It symbolizes the infinite number of present and future uses of Bakelite Corporation's products"



DARDELET THREADLOCK

—*the true self-locking bolt and nut*

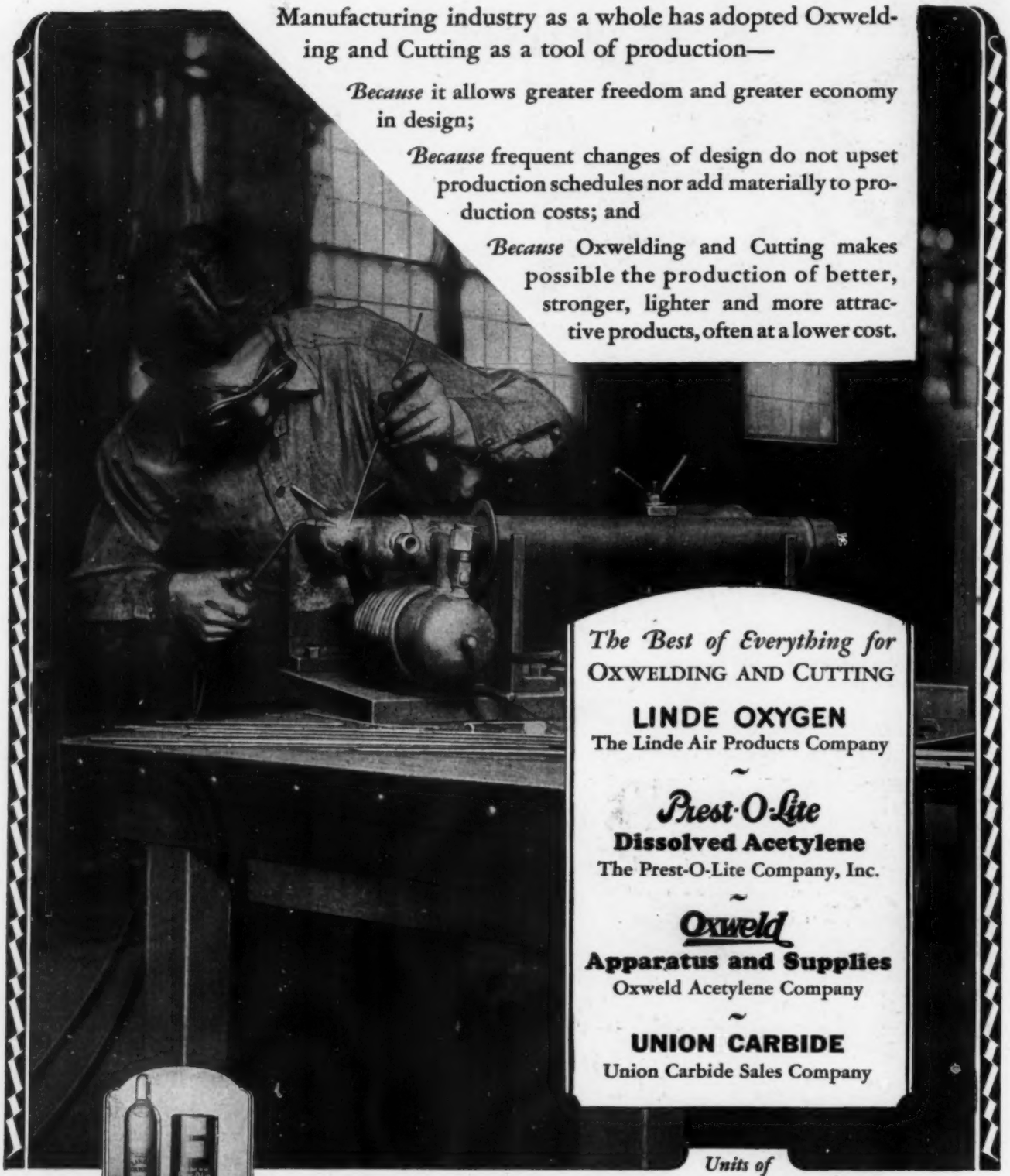
that eliminate lock washers, cotter-pins, jam nuts and other nut holding devices. In actual service in a wide range of applications in many fields of industry Dardelet bolts and nuts have not worked loose even under severest operating conditions.

Samples On Request

DARDELET THREADLOCK CORPORATION

120 Broadway, New York

Don't hesitate—take this advantage



Manufacturing industry as a whole has adopted Oxwelding and Cutting as a tool of production—

Because it allows greater freedom and greater economy in design;

Because frequent changes of design do not upset production schedules nor add materially to production costs; and

Because Oxwelding and Cutting makes possible the production of better, stronger, lighter and more attractive products, often at a lower cost.

The Best of Everything for
OXWELDING AND CUTTING

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Dissolved Acetylene
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UNION CARBIDE
Union Carbide Sales Company

Units of

UNION CARBIDE AND CARBON CORPORATION

General Offices UCC *Sales Offices*

30 East 42nd Street, New York, N.Y. In principal cities of the country

55 Oxygen Plants–38 Acetylene Plants–99 Oxygen Warehouses–100 Acetylene Warehouses–38 Apparatus Warehouses–235 Carbide Warehouses

Imagine the Savings!

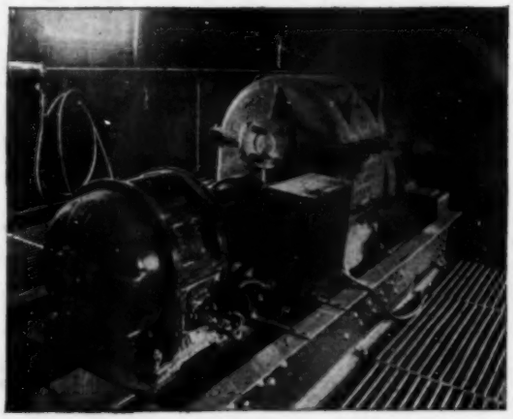
IMAGINE what a difference it would make in the efficiency and economy of the machine drives in some industrial plants if the gearing were as well selected and maintained as the gearing on the turbines in the power plant. Often, the geared drives used with production equipment seem to have been selected with regard only to the attainment of the correct machine speed. Economy of operation and maintenance are too often neglected.

Of course, the production departments of plants where such poor practice is found will argue that suitable gearing costs too much. The idea will be advanced that it is better to endure losses in power and high cost of maintenance than to run up the fixed charges by being too particular about the gears This view, however, takes no account of the losses in production volume that follow the use of misapplied, unsuitable, but cheap gearing.

When the management of plants now permitting such wasteful practices realizes the waste that is going on, changes will be made. The selection and maintenance of gearing in the production department will be put in charge of the power engineer, who by training and experience is fitted to carry out the most economical procedure. And when this step is taken, imagine the savings that will be made!

Editorial
from Power

Turn Imagination into Reality



WESTINGHOUSE-NUTTALL gear units are not merely a more compact method of reducing speed—their higher efficiency and more lasting dependability minimize those costly losses in production volume, and in power. Because they are totally enclosed in oil-tight and dust-proof cases, they require no attention except occasional oiling. What an obvious saving all this means over the often misapplied, exposed drives!

Westinghouse-Nuttall gear units, the outcome of forty years of scientific development, serve the industry through unmatched quality.

Our nearest representative will gladly show you how to turn imaginary savings into reality.

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NUTTALL WORKS PITTSBURGH, PA.
CANADIAN AGENTS: LYMAN TUBE AND SUPPLY COMPANY

Westinghouse

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Industrial Apparatus includes - -

Arc Welding Equipment
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Panelboards
Porcelain Insulators
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NEW!

SHIELDS MILLING MACHINES

Prompt Deliveries of Most Sizes

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No. 2—Heavy Duty
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Plain and Universal

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THOMAS PROSSER & SON

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ON CAST IRON

A WIDIA tool taking a roughing cut on an automatic setup ran for 18 days without grinding. High speed tools were ground every hour.

Exclusive Distributors of WIDIA Tungsten Carbide Alloy

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CUTTING TOOLS

Ames Upright Thickness Gauges

For measuring and testing parts in quantity with speed, accuracy and economy. Readily applied to the job—Complete in every detail—Variety of standardized mountings.

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High Speed Ball Bearing Drilling Machines

A bench type unit that will render greater profits in small hole drilling. Speedy. Its rigid design insures accuracy.

Capacity up to ⅝" drills. Spindle speeds from 2000 to 8000 r.p.m. The highest grade radial and thrust ball bearings in dust-proof mountings are provided. Belt and motor driven, bench, pedestal and gang types as required.

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"B"

"C"

"D"

A size and style for every purpose

Simplicity, low cost and fitness for the particular oiling condition characterize these popular Bennett Oil Cups.

Made in sheet steel and brass. Write for Catalog and samples.

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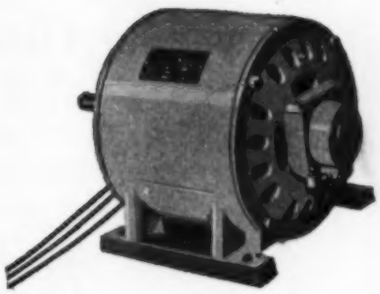
HANDY-TOP OIL CUPS

for the BIG PULL



You wouldn't expect a plough horse to win a steeple chase. Why expect ordinary motors to do the unusual?

Zobell Motors are custom built . . . in quantities to your special order. Where other motors fail, a Zobell can meet the requirements because it is designed for the job.

Look over your service records and let us try your toughest propositions first.

Ranges 1 to 15 hp., A.C. or D.C.

Odd shapes — shaft extensions — or special control if desired.

ZOBELL
HIGH TORQUE MOTORS

ZOBELL ELECTRIC MOTOR CORPORATION
GARWOOD, NEW JERSEY.

2927

Contract Work

THE HARTFORD SPECIAL MACHINERY CO.

TOOLS AND FIXTURES

HARTFORD, CONN.

ESTIMATES PROMPTLY FURNISHED

SPECIAL MACHINERY DESIGNED AND BUILT

DESIGNERS AND BUILDERS OF SPECIAL MACHINERY.
PARTS MANUFACTURED IN QUANTITIES.

LINCOLN MACHINE COMPANY
PAWTUCKET, R. I.

Have Your Dies, Jigs, Fixtures and Bakelite Molds Made by Krasberg

First Class Work and Service Always

Also Contract Manufacturing of Metal Articles or Parts
37 years of experience in building special machinery

Krasberg Tool & Mfg. Co.
2156 Fulton St., Chicago, Ill.

WADE

The experience gained over a period of 35 years in the making of Jigs, Fixtures, Dies, Fine Tools and Special Machines enables us to serve you satisfactorily. Send samples or blueprints for estimate.

WADE TOOL CO.
WALTHAM, MASS

WE SPECIALIZE

on tools that incorporate the Five Fundamental Tool Virtues. As a result we offer to make for you:

Tools that are time saving.
Tools that are foolproof.
Tools that are easy to manipulate.
Tools that will give largest possible production.
Tools that will give absolute interchangeability.

Send us your blueprints and specifications. We specialize in difficult toolwork such as the average toolroom has difficulty in handling. Will gladly furnish estimate and will make prompt delivery.

Precision Engineering Co.
(formerly Arthur Brock Tool & Mfg. Works, Inc.)
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Small Grey Iron Castings

(SOFT)

For quantity production: *easily machined.* Nickel chromium or manganese alloys if desired. Estimate?

KLINE HARDWARE CO.
Allentown, Pa.

COMMERCIAL HEAT TREATING

Carburizing, Hardening, Tempering and Coloring in quantity

AMERICAN METAL TREATMENT CO.
Elizabeth, N. J.

DIES—JIGS—FIXTURES
Special Machinery
The COLUMBUS
Die Tool & Machine Company
Columbus, Ohio.

Machine Work Wanted

Franklin Machine Company
Engineers Founders Machinists
Providence, R. I.

Corliss Steam Engines, Textile Machinery
Special Machinery of all kinds

THE HAMILTON TOOL COMPANY
Engineers and Tool Makers

High quality time saver tools, dies, jigs and special machinery built to order.
Send your samples or blue prints for our estimate.

220-222 N. B. St., Hamilton, O.

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A.M.

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ONE machine shop foreman wanted. Must be good executive. Write for full particulars and state experience and ability. P-452, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

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FIRST-CLASS tool and die designers. Preferably with some experience on die casting die design. Permanent positions for right party. Give full particulars as to age, education, experience, salary, etc. in first letter. Applications held confidential. P-449, American Machinist, Tenth Ave. at 36th St., New York.

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GOOD efficient jig and fixture tool draftsmen accustomed to Auto industry. P-441, American Machinist, Tenth Ave., at 36th St. New York.

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FOREMAN—Experienced on machine building, machine repairs and making of production tools, taps and dies. Man with pipe-fitting shop experience preferred. Give experience, references and salary expected. Address: Detroit Brass and Mallable Wks., Wyandotte, Mich.

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MACHINISTS wanted—Steady work and good pay for fast, skilled machine men. Edward A. Whaley & Company, Norfolk, Virginia.

First Class Engine Lathe

Grinder, Horizontal Boring Mill, Radial Drill and J. & L. operators experienced on machine tool work. Abundance of work. Give full particulars in first letter.

THE COLUMBUS DIE, TOOL & MACH. CO.
Columbus, O.

WANTED

First Class Draftsman

On Jigs and Fixtures. Light Interchangeable Work.

SAVAGE ARMS CORP.
Utica, New York

WANTED

HIGH CLASS

Sales Executive

To act as General Sales Manager of National Sales Organization for high grade machinery. Must possess sales promotion ideas, be a good executive, capable of handling men to get the best out of them. Ability to build up and develop individual men important. Sales handled through branch offices and field men. Age, 30 to 40 preferred. Give experience and personal description in first letter.

P-437, American Machinist,
Tenth Ave. at 36th St., New York City

POSITIONS VACANT

Wisconsin

ASSISTANT to factory manager, about thirty-five years old, with at least fifteen years mechanical experience. Must have some engineering ability but need not be a graduate engineer. Prefer someone who has worked his way through machine shop and drafting room and has knowledge of tool designing and a thorough knowledge of machine shop manufacturing procedure and whose theories have been evolved from practical experience. Must possess initiative and ambition. Excellent opportunity to work into good executive position. In reply give full details of experience. Answers will be held strictly confidential. P-432, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

Wir suchen zum baldigen Eintritt

einen tuechtigen, technischen Produktions-Leiter

fuer unsere Betriebe, in denen wir speziall den Bau von Revolver-Automaten und Spezialmaschinen fuer den Automobilbau pflegen. Der betreffende Herr muss den Maschinenbau absolut beherrschen, und einen Betrieb von etwa 1000 Arbeitern selbststaendig in Gemeinschaft mit dem technischen Direktor leiten koennen.

Eben daselbst wird noch

ein tuechtiger Konstrukteur

gesucht.

Im Auftrage der PITTLER A. G. LEIPZIG sind Bewerbungen nur an A. F. Greiner. Consulting Engineer, Boyer Building, Detroit, Michigan, zu richten.

MACHINE TOOL BUILDER

Located in the East

will pay

ATTRACTIVE SALARY

to a

TOOL DESIGNER

with experience on machine tools.

Applications will be considered only from men with experience

P-446 American Machinist, Tenth Ave. at 36th St., New York City

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000 and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established nineteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 266 Main Street, Buffalo, New York.

$3,000.00-$30,000.00 men find our service effective in making connections. Individual. Confidential. Refund agreement. Not agency. Jacob Penn, Incorporated, 9 Park Place, New York.

POSITIONS WANTED

Connecticut

ASSISTANT to general manager, works or production manager, 28 years of industrial and commercial experience; production, design, estimating, costs, selling, purchasing, maintenance, plant layout and organization. Am seeking an executive opportunity to use my accumulated experience. Records of achievements furnished. Position in Connecticut preferred. PW-454, American Machinist, Tenth Ave. at 36th St., New York.

CHIEF DRAFTSMAN or designer, experienced on heavy automatic machinery, American, age 42. Will call for interview. PW-451, American Machinist, Tenth Ave. at 36th St., New York.

Illinois

TOOLROOM foreman, with proven ability, wishes to connect with reliable firm. PW-456, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

Indiana

SUPERINTENDENT Screw Machine Products: Familiar with all phases of screw machine products. Having 18 years, experience, 15 years as Supt. and Foreman. Familiar with tools, feeds, speeds and piece work and bonus systems. Age 38, Married. PW-438, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

New Jersey

PRODUCTION EXECUTIVE thoroughly experienced in every phase of production control. Energetic, constructive, and an organizer. Technical graduate, 36 years of age. Highest credentials. PW-440, American Machinist, Tenth Ave. at 36th St., New York.

TOOL, hardener and heat treater. Wishes position, familiar with all kinds of work: 18 years' experience. Will go anywhere. PW-412, American Machinist, Tenth Ave. at 36th Street, New York.

New York

INSTRUCTOR, professor, director. Qualifications: mechanical, engineering, structural, drawing-machine design, vocational, trade and applied mathematics. Vocational trade technical school, university teaching and practical engineering experience; good health, personality, references. PW-448, American Machinist, Tenth Ave. at 36th St., New York.

PRODUCTION superintendent, 16 years' executive experience, mechanical engineer; excellent record. Various manufacturing lines. "Bryant," 55 W. 45th St., New York.

REPRESENTATIVE WANTED

To Sell Well-Known Machine Tool Line

on strict commission basis in Chicago, Cleveland, Pittsburgh and Pacific Coast territories. Preferred live salesmen with only a few additional lines. Large concerns will not be considered. PW-450, American Machinist, Tenth Ave. at 36th St., New York.

REPRESENTATIVE AVAILABLE

For Michigan Territory

Small tools for production shops, preferably cutting tools. Well known throughout State. Seventeen years' experience. Have facilities for handling Detroit stock. Can furnish best of references. RA-455, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

To the Manufacturer in Need of a Broad-Gauged Factory Manager.

A man, age 38, with a good engineering education and 15 years of continuous experience in the manufacture of mechanical and electrical products is open for a new connection. A good organizer and well versed in labor problems and wage incentives. Skilled in design, labor saving equipment and competent to control costs and schedule production.

PW-444, American Machinist
520 N. Michigan Ave., Chicago, Ill.

SALESMAN AVAILABLE

SALESMAN, having broad experience selling tool steels and metal working machinery, desires position. SA-447, American Machinist, Tenth Ave. at 36th St., New York.

BUSINESS OPPORTUNITY

Machinery Specialty Wanted

Something to make, or the job of marketing a machine specialty. Have small shop, some capital, long and successful experience in selling a machine by direct mail to 70 per cent of trade using such devices and find market saturated. Will consider outright purchase, manufacture on royalty or job of marketing. Don't want experimental work. BO-430, American Machinist, Tenth Ave. at 36th St., New York.

WANTED

PRODUCTION machine wanted, to punch annular rings from sticky plasters similar to corn plasters now on the market. Allcock Mfg. Co., Factory Office, Ossining, N. Y.

Tool Salesman Wanted

Live salesman handling one or two tool specialties in New York Metropolitan District to represent old established lathe and drill chuck manufacturer.

SW-445 American Machinist
Tenth Ave. at 36th St., New York City

For Sale or Rent

Machine Shop

Situated in Southwestern Ohio

Will sell as a whole or in part or will rent building and equipment. Will also consider the manufacture of parts or complete machines for any responsible concern having more work than they can handle in their own plant.

For full information and list of equipment, address

B.O.-388, American Machinist
Tenth Avenue at 36th Street
New York, N. Y.

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A No. 16 Blanchard Grinder in first class condition; also a thousand ton hydraulic press. State prices and details in first letter.

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G-6

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Notice To Advertisers!

Owing to the Fourth of July, Thursday, July 4th, the *"Searchlight"* pages of the July 11 issue of

AMERICAN MACHINIST

will close one day in advance of the regular schedule.

Advertisers will be cooperating with us by sending new advertisements or changes of copy early.

FINAL
CLOSING TIME
10 A.M. Wednesday,
July 3rd.

ReMANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

Reg. U. S. Pat. Off.

Economical to buy and to use. Ready for IMMEDIATE DELIVERY

Write regarding any machine not listed.

LATHES

1—66"x21' Putnam.
1—56"x16' Lodge & Shipley.
1—48"x50' Pond.
1—45"x24' Pond.
1—42"x50' Putnam, Gd. Hd.
1—42"x50' American Gd. Hd.
1—42"x26' American, Gd. Hd.
1—38"x26' Pittsburgh.
1—36"x71' American, Gd. Hd.
1—36"x42' Gisholt Gun Borer.
1—30"-30"x32' LeBlond.
1—30"x14' LeBlond.
1—30"x14' American.
1—30"x11' H. S. & G.
1—27"x14' Reed-Prentice, Gd. Hd.
1—27"x10' LeBlond.
9—26"x18' Bridgeford.
3—26"x16' N.-B.-P.
2—26"x16' Whit.-Blaisdell.
10—26"x16' Bridgeford.
3—26"x14' Bridgeford.
5—26"x14' N.-B.-P.
3—26"x13' Wickes.
3—26"x12' Putnam.
5—26"x12' Bridgeford.
13—26"x11' Wickes.
40—26"x10' N.-B.-P.
15—26"x10' Canada.
15—26"x10' Whit.-Blaisdell.
14—26"x10' Bridgeford.
21—26"x 9' Bridgeford.
10—26"x 8' Bridgeford.
1—26" LeBlond Crank Shaft Lathe.
9—25"x12' LeBlond.
20—25"x10' Sidney.
1—24"x10' Cisco.
5—20x22"x16' American.
2—20-22"x12' L. & S., Sel. Gd. Hd.
5—20x22"x13' American.
2—20-22"x8' American, M.D.
30—20-22"x8' American.
1—19"x12' LeBlond G.H.
1—18"x9' Chard.
3—18-20"x8' L. & S., Sel. Gd. Hd.
1—18"x 8' Lodge & Shipley.
1—18"x 8' Hendey.
1—16"x12' Sundstrand Mfg.
1—16"x10' Sundstrand Mfg.
1—16"x 8' Lodge & Shipley.
1—15"x 6' LeBlond.
1—14"x 6' American, Gd. Hd.
3—14"x 6' Flather.
3—14"x 6' Rockford.
1—14"x 6' Hendey.
5—3¼"x60" Fitchburg Loswing.
1—3¼"x108" Loswing.
2—4"x60" Loswing.

TURRET LATHES

1—26" Libby.
26—24" Davis.
10—24" Steinle.
5—24" Gisholt.
3—21" Gisholt.
1—No. 2-B Foster, Univ.
1—No. 3 Cincinnati Acme.
1—No. 3-A Warner & Swasey.
1—No. 6 W. & S.
1—No. 7 3" Foster, Gd. Hd.
36—21"x10' LeBlond, Univ.
1—21"x8' LeBlond.
3—20"x8' American.
2—No. 6 2" B. & S.
24—19"x8' LeBlond, Univ.
25—19"x8' LeBlond.
2—3x36" Jones & Lamson.
5—2-spdl. Jones & Lamson.
1—No. 4 Warner & Swasey, Univ.
1—18" Acme.
3—16" Cincinnati-Acme-Fox
4—14" Warner & Swasey.

DRILL PRESSES

1—2-spindle Sipp.
1—2-spindle H. & W.
1—4-spindle H. & W.
1—6-spindle H. & W.
1—No. 3 6-spindle Foote-Burt.
2—No. 4 4-spindle Foote-Burt.
2—No. D-31 Fox Mult.
1—No. 12-C Fox Mult.
1—No. D-8 Colburn.
1—22" Barnes, Self-Oiling.
1—28" Snyder.
2—30" Snyder.
1—30" Superior.
1—No. 510 Baker.

OUR GUARANTEE:

Your money back if you return a machine within thirty days. No excuses necessary.

MILLING MACHINES

1—No. 4-A Brown & Sharpe.
2—No. 3 Brown & Sharpe.
1—No. 2 Brown & Sharpe.
1—No. 2 Kempsmith.
2—No. 2-Y Brown & Sharpe.
2—No. 20 Oesterlein.
1—No. 1½-B Milwaukee.
1—No. 1½ Rockford.
12—No. 25 Becker.
1—No. 0 Brown & Sharpe.
1—No. 4 Cincinnati, Univ.
1—No. 4-A Brown & Sharpe, Univ.
1—No. 3 Becker, Univ.
1—No. 3 G. H. Hendey, Univ.
1—No. 35 Ohio, Univ.
1—No. 1 Milwaukee, Univ.
3—Type B Briggs.
1—Putnam, Semi-Auto.
175—P. & W. Hendey, Becker and Garvin Lincoln Millers.

SHAPERS

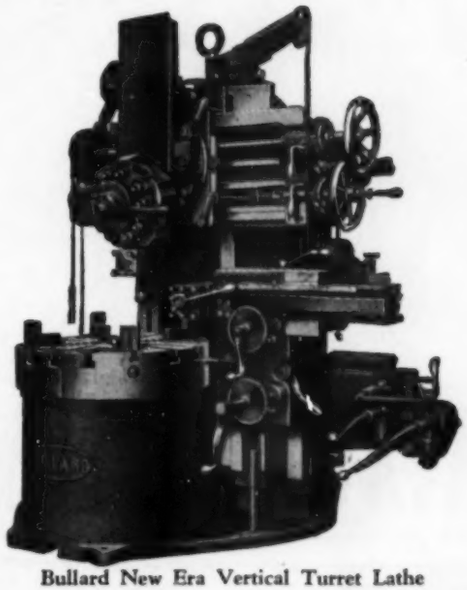
1—24" Potter & Johnston.
1—21" Averbeck.
1—20" Columbia.
1—20" Davis.
1—20" Gould & Eberhardt.
1—16" Gould & Eberhardt.
1—16" Columbia.

PLANERS

1—72x84"x12' Gray.
1—60x48"x12' N.-B.-P.
1—48x48"x16' N.-B.-P.
1—48x48"x10' Gray.
1—48x48"x10' N.-B.-P.
3—36x36"x18' Cincinnati.
1—36x36"x16' Rockford.
1—36x36"x16' Ohio.
2—36x36"x8' Ohio.
1—36x32"x8' Cincinnati.
1—36x30"x20' Whit.-Blaisdell.
1—36x30"x18' Whit.-Blaisdell.
1—30x30"x14' Niles-Bement-Pond.
1—30x30"x 8' Niles-Bement-Pond.
1—30x30"x 8' Liberty.
1—26x26"x10' Gray.
1—24x24"x 8' Powell.
1—24x24"x 6' Gray.
1—24x24"x 6' Cincinnati.
3—24x24"x 6' Woodward-Powell.

VERTICAL BORING MILLS

1—10' Niles.
1—96" Betts.
1—72" Cincinnati.
1—72" Niles.
1—60" Pittsburgh.
1—51" Baush.
1—51" Bullard.
2—48" Colburn.
3—42" Gisholt.
1—42" Colburn.
1—36" Bullard, Rapid Prod.
3—36" Gisholt.
2—32" Wing.
1—28" Flather.
1—30" Gisholt.
2—24" Bullard "New Era."



Bullard New Era Vertical Turret Lathe

GEAR CUTTERS AND HOBBERS

1—No. 5 60" Brown & Sharpe.
1—No. 4 48" Brown & Sharpe.
1—36"x12" G. & E.
1—No. 36-H. G. & E.
1—No. 18-H. G. & E.
4—No. 12 Barber-Colman.
4—No. 3 26" Brown & Sharpe.
2—No. 6 Fellows.
1—No. 64 Fellows.
1—No. 3 Barber-Colman.
1—18" Gleason.

HAND SCREW MACHINES

1—No. 10 3" Bardons & Oliver.
3—No. 6 2⅝" Warner & Swasey.
1—No. 7 Foster.
1—No. 6 2¼" Warner & Swasey.
1—2"x10" Acme.
1—No. 3 Bardons & Oliver.
1—No. 4 Warner & Swasey.
1—1x15" Pratt & Whitney.

AUTO SCREW MACHINES

2—No. 6-A Potter & Johnston.
2—No. 5-A Potter & Johnston.
1—No. 56 National Acme.
1—1"x5" New Britain.
1—¾" Gridley Single Spindle.
1—No. 33 New Britain.

SLAB MILLING MACHINES

1—24x12"x20' Ingersoll.
3—24x24"x12' Ingersoll.
1—36x30"x7' Newton.
1—45x17' Ingersoll.
1—50"x20' Ingersoll.
1—48x24"x12' Ingersoll.
1—No. 3 92x54"x15' Beaman & Smith Milling and Boring Machine, Planer Type.
1—Beaman & Smith open side.
1—3-spdl. Beaman & Smith.

HORIZONTAL BORING MACHINES

1—5" Bar Ingersoll.
1—No. 12 Pawling & Harnischfeger.
1—4" Gisholt.
1—2-spindle Espen-Lucas Boring Milling and Drilling Machine.
1—No. 3 Beaman & Smith Engine Frame and Cylin. Borer.
1—Beaman & Smith Cylinder Boring and Milling Machine.
4—No. 1 Barrett.
4—Rockfords.

VERTICAL MILLERS

1—Model ACS 2-spdl. Becker.
2—Model SD Becker.
1—No. 6 Becker.
3—No. 5 Becker.
3—No. 4 Cincinnati.
2—No. 3 Cincinnati.
3—No. 2 Cincinnati.
1—No. 4B Becker.
1—No. 3 Becker.
1—No. 2 Brown & Sharpe.
1—Model C8 Becker.
1—No. 1 Becker.

GRINDERS

1—26"-37½"x96" Norton Gap.
1—18x96" Norton.
1—16x52" Landis.
2—16x50" Norton.
1—14x72" Norton.
1—14x50" Norton.
5—14x36" Norton.
2—12x120" Landis.
1—12x36" Modern.
2—10x72" Norton.
2—10x72" Landis.
3—10x52" Landis.
6—10x50" Norton.
1—No. 14 10x18" B. & S.
1—10x36" Norton.
5—10x36" Landis.
2—10x24" Landis.
4—10x24" Norton.
2—No. 12 8x36" B. & S.
7—6x32" Norton.
1—6x20" Landis.
1—No. 10 6x30" B. & S.
2—No. 3 B. & S. Univ.
2—No. 2 B. & S. Univ.
1—No. 50 Heald.
1—No. 60 Heald.
2—No. 70 Heald.
1—No. 75 Heald.
1—No. 10-A Bryant Internal.
2—No. 20 Bryant Internal.
1—No. 7 Gardner Dis.
2—14x36" P.&W. Surface.
1—No. 210 Heald Ring.
3—5x18" Ott Plain Grinders.

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First Class Condition Guaranteed All Leading Standard Makes.

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1—Bullard 24-in. New Era.
1—Baush 42-in. ver., 2 heads.
1—Niles 42-in. ver., 2 heads.
1—N.B.P. 44-in. side head vertical.
1—N-B-P 10-16-ft. ver., 2 heads.
1—Pond 10-24-ft. ver.
1—Cleveland 2½-in. bar., hor.
1—Universal 3½-in. bar., hor.
1—Fawling & Harnischfeger 3¼-in. bar.
1—N-B-P 4½-in. bar, Duplex Contr. hor.
1—Rockford No. 2 horiz.
1—Betts 12-ft. ver., 2 heads.
1—Betts 16-24-ft. Extension Ver.

DRILLS—MULTIPLE SPINDLE

16—Baush Nos. 1, 2, 3, 4.
5—Detroit 5 spindle.
1—P. & W. Nos. 12, 13.
1—Moline No. 3-D Cyl. Borer.

DRILLS—UPRIGHT

1—Allen 4 spindle.
2—Barnes 20 and 24-in. Camel Back.
1—Foote-Burt, 4 spindle.
6—Henry & Wright 2, 3, 4, 6 spdl.
1—Pratt & Whitney No. 2 Gun.
1—New Turner No. 3 ver.
1—Leland & Gifford 2-spdle, BB.

DRILLS—RADIAL

1—Dreses 2½-ft.
3—Western 3-ft. Pl.
4—Amer. 6, 7, 8-ft. Pl. trip. pur.
1—Baush 6-ft.
2—Dreses 5-ft., 6-ft. Pl.
1—N-B-P 96-in. Plain.
1—N.-B.-P. 5-ft. Semi-Univ.
1—American 7-ft. triple pur.

GEAR CUTTERS

7—B.&S. 3x26, 3x36, 4x36.
3—B.&S. No. 6, 60-in. cap.
1—G.&E. No. 18-H.
1—Cincinnati 16-in. Gear Hobber.
3—Fellows Gear Grinders.
3—Glea. 15 in. Spir. Bev. Roughers.
1—Gleason 6-in., 11-in., 18-in
1—Gleason 24-in. Bevel Gr. Planer.
2—Fellows Nos. 6, 61, 615.
1—Gould & Eberhardt 36-in.

GRINDERS

3—B.&S. Nos. 1, 2, 3.
4—Cin. No. 2, 12x36 Pl.
9—Landis 6x18, 10x24, 10x36, 12x36, 12x96 Pl.
6—Norton 3x18, 6x32, 10x24, 10x36, 10x50, 16x36 Pl.
2—Landis 10x52 Cam.
1—Heald 8-in. Rot. Surf.
1—Springfield Brandes vert. Gr. Pl.
12—Heald Nos. 65, 60, 70.
1—Bath Spline.
1—Norton 16x50 Crank.

HAMMERS

1—New Bradley 30-lb. Helve.
1—Chambersburg 400-lb. Bd. Drop.
1—B.&S. 800-lb. Drop.
1—Toledo 1500 lb. Bd. Drop.

MILLING MACHINES

6—B. & S. Nos. 2, 2-B, 3, 4, 13-B Pl.
8—Cincinnati Nos. 2, 3, 3-B, 4 Pl.
2—Garvin No. 13½ Pl.
3—Garvin No. 1½, 2 A Univ.
13—Becker Nos. 3H, 4B, AB, 5C, 6, Cl. Ver.
7—P.&W. 4½x12, 6x14, 6x48, 6x80 Thread.
11—P.&W. 5, 8, 10, 12-in. Auto.
1—B. & S. No. 2 Univ., cone pulley.

LATHES

1—Hendy 16-in.x8-ft., grd. bd.
8—Lodge & Shipley 18-in.x8-ft. Selective grd. bd., with taper att.
1—LeBlond 26-in.x10-ft. Dup. Crank.
1—Johnson 30-in.x12-ft., M.D.
1—Hendey 24-in.x12-ft.
1—Bridgeford 42-in.x38-ft., grd. bd.
1—American 36-in.x24-ft.
1—Hendey 20-in.x10-ft. grd. bd.
1—Hendey 14-in.x6-ft. grd. bd.
1—Boye & Emmes 24-in.x12-ft., taper.

Lathes of all sizes and types.

AUTOMATIC SCREW MACHINES

14—Cleveland ⅝, ⅞, ¾, 4¼ in. A.
4—Cleveland ⅝, ⅞, 1½, 1¾ in. B.
17—Gridley ¾, ⅞, 1¼, 1⅜, 1¾, 2¼ in., 4 spdle.
10—Gridley 3¼, 4¼ in., single.
6—New Britain Nos. 23, 24, 53.
4—Natl. Acme Nos. 52, 54, 56, 515.
11—P.&J. Nos. 5-A, 6-A.
1—Gridley 4¼-in. single spdle.
1—Gridley 2½-in. single spdle.

TURRET AND SCREW MACHINES

1—Acme Fox Monitor.
6—Foster Nos. 2, 4, 6.
4—Greenlee 2¼x26.
10—J. & L. 2¼x24, 3x36.
3—W. & S. No. 4 Univ.
1—W. & S. No. 6.
1—B. & S. No. 6.
1—Steinlee 24-in. Turret.
1—Milholland No. 4.
1—W. & S. No. 3-A Bar & Chuck.

SHAPERS AND SLOTTERS

1—Dill 15-18-in. Slotter.
1—Niles 30-in. Slotter.
2—Potter & Johnston 15-in.

PLANERS

2—Putnam 26x26x8-ft., 2 heads.
1—Gray 38x38x26-ft., 3 heads.
1—Woodward & Powell, 36x36x16-ft., 4 hds.
1—Detrick & Harvey 30-in.x10-ft.; single hd. openside.
1—Cincinnati 48x48x16-ft., 4 hd.

MISCELLANEOUS

LaPointe Broaches (Hudson & New London) 1, 2, 3 and 4.
1—Laidlaw, Dunn & Gordon, 17x16 Air Compressor.
3—Clayton Air Compressors.
2—Keller E-3, E-302 Engravers.
5—Fisher No. 1 Oil Groovers.
1—Wicks Single End Punch.
1—Cleveland Model "C" double end Punch and Shear.
1—Espen Lucas 43-in. Cold Saw.
1—Campbell 3/16-in. Nibbler.
1—Allen 10-ft. Reach Port. Rivetter.
1—Nilson 3-slide Wire Former.
1—Shuster ¼-in. Wire Straightener.
1—Riehle 100,000 lb. Testing.
1—New Ajax Reclaiming Roll.
1—Southwark Hydraulic Bend. Roll.
1—New Rockwell oil burning.
1—Murchey Duplex Nipple Mach.
1—Ajax 3-in. Upsetter; steel base.

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Only Prompt Action Will Reserve Them

Lathes

3—12-in.x5-ft. Hendey yoke head engine lathes, with taper attachments.
2—12-in.x5-ft. Hendey yoke head engine lathes, standard equipment.
1—14-in.x6-ft. Hendey yoke head engine lathe, standard equipment.
1—14-in.x6-ft. Monarch engine lathe, standard equipment.
1—14-in.x6-ft. LeBlond Q.C. engine lathe.
1—16-in.x6-ft. Flather Q.C. engine lathe.
1—16-in.x6-ft. Monarch Q.C. engine lathe.
1—16-in.x6-ft. Reed S. C. engine lathe.
1—17-in.x8-ft. LeBlond production lathe.
1—18-in.x8-ft. American Q.C. engine lathe.
1—18-in.x6-ft. Rahn Mayer S. C. engine lathe.
1—18-in.x8-ft. Reed S. C. engine lathe.
1—18-in.x8-ft. Shumaker Boye Q.C. engine lathe.
3—20-in.x9-ft. Wicks production lathes.
1—20-in.x8-ft. Monarch Q.C. engine lathe.
2—22-in.x9-ft. Amerian mfg. lathes.

Drills

1—No. 314 Baker heavy duty drill.
1—No. 216 Baker heavy duty drill.
1—Rockford H.D. all geared drill.
1—No. 25 Foote-Burt s. p. drill.
1—No. 24 Foote-Burt s. p. drill.
1—No. 65-D-5 Moline holehog 9 spd. drill.
1—No. 17 Foote-Burt 4 spd. drill.
1—No. 2 Foote-Burt 5 spd. rail drill.
1—No. 1 Bausch 16 spd. multi drill.
1—Fox 8 spd. multi drill.
2—Barnes horiz. radial drills.
3—4 spd. Allen high speed drills.
2—4 spd. Avey high speed drills.
1—3 spd. Allen high speed drill.
1—3 spd. Leland & Gifford high speed drill.
1—20-in. Barnes camel back drill.
1—26-in. Aurora sliding head drill.
1—32-in. Cincinnati sliding head drill.
1—36-in. Aurora sliding head motor drive drill.

Mills

1—No. 4 LeBlond plain cone drive.
2—No. 3 Cincinnati plain cone drive.
1—No. 2 Cincinnati all geared high power plain s. p. d.
1—No. 2 Cincinnati plain cone drive.
1—No. 2B Rockford universal milling machine, cone drive, vertical head.
1—No. ½ Valley City universal milling machine.
1—No. 3 Brown & Sharpe vertical milling machine, all geared, s. p. d.
5—Gooley & Edlund mfg. mills, all sizes.
3—12-in. Cincinnati mfg. mills.
1—28-in. Bullard vertical boring mill.
1—4-in. Bar Niles boring and milling machine.

Shapers and Planers

1—15-in. Potter & Johnston belt drive shaper.
4—16-in. Gould & Eberhardt belt drive B.G. shapers.
1—16-in. Ohio B.G. shaper.
1—20-in. Kelly B.G. belt drive shaper.
3—20-in. Gould & Eberhardt B.G. belt drive shapers.
2—24-in. Gould & Eberhardt B.G. belt drive shapers.
1—26-in. Smith & Mills B.G. belt drive shaper.
1—30-in.x30-in.x8-ft. Gray planer, two heads on cross rail.
1—30-in.x30-in.x8-ft. Cincinnati planer, two heads on cross rail.
1—36-in.x36-in.x10-ft. Bickett iron planer, two heads on cross rail.

Grinders

1—No. 3 Brown & Sharpe universal grinder.
1—No. 2 Bath universal grinder.
2—No. 2 Brown & Sharpe universal grinders.
2—No. 10 Brown & Sharpe plain grinders.
1—14x36 Queen City plain self-contained grinder.
3—6x32 Norton plain grinders.
2—6x15 Fitchburg plain grinders.
4—No. 65 Heald cylinder grinders.
1—Madison cylinder grinder.
3—No. 2 Brown & Sharpe vertical surface grinders.
1—14-in. Pratt & Whitney vertical surface grinder.
1—Reed-Prentice vertical surface grinder.
1—No. 3 Wilmarth & Morman surface grinder.
4—7½ H.P. U. S. heavy duty motor drive snagging grinders.
1—No. 15 Bryant internal grinder.
1—No. 10 Bryant internal grinder.

Turret Lathes and Screw Machines

1—28-in. Gisholt 3¼-in. spd.
2—Jones & Lamson dbl. spd. flat turret lathes.
2—No. 2 Warner & Swasey hand screw machines.
3—No. 4 Warner & Swasey hand screw machines, friction head.
2—No. 6 Warner & Swasey friction head hand screw machines.
2—No. 4 Barton & Oliver friction head turret lathes.
4—18-in. Springfield Fox Monitor lathes.
8—Only No. 00 Brown & Sharpe automatic screw machines.
2—Only ⅝-in. Gridley multiple spindle automatic screw machines.
2—Only ⅞-in. Gridley multiple spindle automatic screw machines.
1—Only 1¼-in. Gridley multiple spindle automatic screw machines.

Presses

4—No. 35 Niagara solid back pl. flywheel presses.
1—No. 40 Bliss plain horning press.
1—No. 54 Toledo s. s. plain press.
1—No. 55 Toledo s. s. plain press.
1—No. 63 Consolidated s. s. geared press.
1—No. 8 Rockford s. s. plain press.
1—No. 66 Bliss Consolidated s.s. dbl. geared press.
1—No. 4 Bliss solid back press.
1—No. 857 Toledo rack and pinion press.
1—No. 666 Toledo knuckle joint press.

Miscellaneous

1—24x16 Bury belt drive air compressor.
1—9¼x4x8 Ingersoll-Rand H.P. air compressor.
1—2½-in. Landis bolt cutter.
2—No. 3 dbl. spd. LaPointe broaching machine.
3—4½-in. Williams cutting off machines.
2—Pridemore combination elec. roll-over machines.
10—High speed riveting hammers, all sizes.
2—10-in. Allis-Chalmers high service centrifugal Pumps.
3—9x7x12 Worthington duplex steam pumps.
1—36-in. Berlin Royal Invincible 3-drum sander.
1—42-in. Berlin Royal Invincible 3-drum sander.
1—Rickert & Shafer ½-in. vertical radial tapping machine.
6—No. 2 Garvin tapping machines.
1—McGee mtr. drive wiring and edging machine.

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1—36-H GOULD-EBERHARDT HOBBER.
1—NO. 12-H GOULD-EBERHARDT HOBBER.
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1—60" BROWN-SHARPE AUTOMATIC SPUR.
1—48" BROWN-SHARPE AUTOMATIC SPUR.
1—36" GOULD-EBERHARDT AUTOMATIC SPUR.
1—NO. 3 CINCINNATI AUTOMATIC SPUR.
1—NO. 1 BILTON AUTOMATIC SPUR.
1—NO. 13 BROWN-SHARPE SPUR AND BEVEL.
1—36-B GOULD-EBERHARDT SPUR AND BEVEL.
1—54" GLEASON BEVEL PLANER.
1—24" GLEASON BEVEL PLANER.
9—18" GLEASON GENERATORS.
1—15" GLEASON GENERATOR.
1—11" GLEASON GENERATOR.
1—6" GLEASON GENERATOR.
1—NO. 1 CROSS TOOTH ROUNDER.

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1—NO. 2-A WARNER-SWASEY BAR, MOTOR DRIVE.
1—26" LIBBY, 7⅛" HOLE, MOTOR DRIVE.
3—18" LIBBY MOTOR DRIVE.
1—21" GISHOLT CONSTANT SPEED MOTOR DRIVE.
6—NO. 4 WARNER-SWASEY AUTOMATIC CHUCK.
1—1"x15" PRATT-WHITNEY AUTOMATIC CHUCK.
1—1½"x18" PRATT-WHITNEY AUTOMATIC CHUCK.
1—2¼"x11" ACME AUTOMATIC CHUCK.
2—2¼"x24" ACME CHUCKING MACHINES.
1—3"x36" PRATT-WHITNEY AUTOMATIC CHUCK.
1—NO. 2 WARNER-SWASEY BAR FEED.
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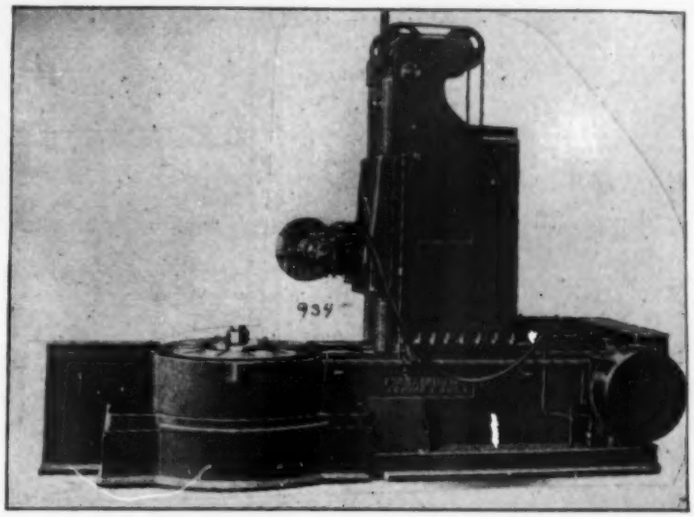

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No. 25 Becker.
No. 28 Ohio (Oesterlein).
No. 1½ Rockford.

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24 in. **Cincinnati** auto. miller (with vert. head)
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20 in. x 8 ft. **L. & Ship.** sel. gd. hd. Q.C. lth (l.t)
20 in. x 8 ft. **Hendey** gd.hd. Q.C. lth, tp.at. (l.t.)
18 in. x 14 ft. **Johnson** gd.hd. Q.C. lth, tpr.att.
18 in. x 10 ft. **Boye & Emmes** Q.C. lth., (tp.at.)
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20 in. **Cincinnati** hvy-duty B.G. cr. shaper
20 in. **Milwaukee** hvy-duty B.G. cr. shaper
20 in. **Stockbridge** hvy-duty B.G. cr. shaper
16 in. **Hollingsworth** hvy-duty B.G. cr. shaper
16 in. **American** hi-duty B.G. crank shaper
16 in. **Gould & Eber.** hi-duty B.G. cr. shaper
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14 in. **Pratt & Whitney** vertical surface grinder (ball bearing spindle), rect. mag. chk
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No. 3 **Rivett** internal grinder
No. 41-20 in. **Besley** motor drive disc. grinder
No. 120 **Gardner** dbl. disc grinder
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No. 4-B Brown & Sharpe **Heavy Plain Miller.**
No. 13-B B. & S. **Manufacturing Miller.**
No. 12 Brown & Sharpe **Manufacturing Miller.**
U. S. **Hand Miller.**
No. 0 B. & S. **Plain Head Screw Machine.**
No. 11 B. & S. **Plain Grinder** 4x30.
No. 6 Diamond **Disc Grinder.**
No. 1 B&S **Surface Grinder.**
6x6-in. Marvel Power **Hack Saw.**
12-in. H&R Metal Cutting **Band Saw.**
26x26-in.x6-ft. Whitcomb **Planer,** 2 heads.

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Flat Turret. 2x24 and 3x36 in. J. & L.
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Grinders, No. 1 and No. 2 Wilmarth & Morman surface
Lathes, 14 in. x 6 ft. Monarch
Lathe, Hamilton, 14 in. x 6 ft. H. S. Comp Rest
Lathe, 20 in. x 8 ft. American geared head
Lathe, 24 in. x 24 ft. Prentiss
Millers, No. 2 Kempsmith Plain, new
Miller, B & S. No. 2 heavy plain
Miller, No. 3 Kempsmith Plain, new
Miller, Briggs type B
Miller, Ingersoll, horisontal
Shaper, 16 in. American back geared crank
Shaper, 24 in. double face bullgear
Shear No. 20, Quickwork, 14 gauge, 30 in. throat
Shear, Pettengill, 60 in. throat
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Timken Roller Bearing Co., Canton, O.

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U. S. Auto. Box Mchy. Co., Newtonville-Boston

Anodes, Electroplating, All Metals
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Cincinnati (O.) Milling Mach. Co.
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Union Twist Drill Co., Athol, Mass.
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New Departure Mfg. Co., Bristol, Conn.

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Greenfield (Mass.) Tap & Die Corp.
Williams Tool Corp., Erie, Pa.

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Lapointe Mach. Tool Co., Hudson, Mass.

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Hanson-Van Winkle-Munning Co., Matawan, N. J.

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Mitchell Engineering Co., Springfield, Ore.

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Johnson Gas Appliance Co., Cedar Rapids, Iowa

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Universal Engineering Co., Frankenmuth, Mich.

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Ex-Cell-O Tool & Mfg. Co., Detroit
Universal Engineering Co., Frankenmuth, Mich.

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Cams
Hartford Special Machy. Co., Hartford
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Imperial Brass Mfg. Co., Chicago
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Stewart Die Casting Corp., Chicago

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Nielsen Inc., Lawton, Mich.

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Boston Gear Works Sales Co., Quincy, Mass.
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Whitney Mfg. Co., Hartford, Conn.

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Noble & Westbrook Mfg. Co., Hartford

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United Chromium, N. Y. C.

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Frew Machine Co., Philadelphia

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Compounds, Cleaning
Hanson-Van Winkle-Munning Co., Matawan, N. J.
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Oakite Products, N. Y.
Compounds, Resin
Bakelite Corp., N. Y. C.
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Philadelphia (Pa.) Gear Wks.

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Barber-Colman Co., Rockford, Ill.
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Butterfield & Co., Derby Line, Vt.
Geometric Tool Co., New Haven, Conn.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Modern Tool Works, Rochester
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

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Oxweld Acetylene Co., Long Island City
Union Carbide & Carbon Corp., N. Y. C.

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Strafer Machy. Co., Jersey City
Taylor-Hall Welding Corp., Worcester

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U. S. Tool Co., Ampere, N. J.

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Danly Mach. Spec., Inc., Chicago
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Geometric Tool Co., New Haven, Conn.
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Landis Mach. Co., Waynesboro, Pa.
Modern Tool Works, Rochester
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Machy. Co., Tiffin, O.

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Butterfield & Co., Derby Line, Vt.
Keller Mech. Engr. Corp., Brooklyn
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Dies, Steel Marking
Noble & Westbrook Mfg. Co., Hartford

Disinfectants
Sulpho-Napthol Co., Boston

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Dogs, Lathe and Milling Machine
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Bay State Stamp Co., Worcester
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Drill Holders
Armstrong Bros. Tool Co., Chicago.

Drill Speeders
Graham Mfg. Co., Providence

Drill and Tap Heads, Multiple
Errington Mech. Laboratory, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Providence, R. I.

Drilling Machines
Hoefer Mfg. Co., Freeport, Ill.

Drilling Machine Heads
Langelier Mfg. Co., Providence, R. I.
Rockford (Ill.) Drilling Machine Co.
U. S. Drill Head Co., Cincinnati

Drilling Machines, Automatic
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Sundstrand Mach. Tool Co., Rockford, Ill.
Rockford (Ill.) Drilling Machine Co.

Drilling Machines, Bench
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Barnes Co., W. F. & John, Rockford, Ill.
Canedy-Otto Mfg. Co., Chicago Hts., Ill.
Clark Electric Co., Jas., Jr., Louisville, Ky.
Langelier Mfg. Co., Providence, R. I.
Rockford (Ill.) Drilling Mach. Co

Drilling Machines, Gang
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Barnes Drill Co., Rockford, Ill.
Chicago Pneumatic Tool Co., New York
Cincinnati Bickford Tool Co., Cincinnati
Foote-Burt Co., Cleveland
Henry & Wright Mfg. Co., Hartford
Rockford Drilling Machine Co., Rockford, Ill.

Drilling Machines, Heavy Duty
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Minster Machine Co., Minster, O.
Rockford (Ill.) Drilling Machine Co.

Drilling Machines, Horizontal
(See Boring, Drilling & Milling Machines, Horizontal)
Baker Bros., Toledo

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Harrington Co., Philadelphia
Henry & Wright Mfg. Co., Hartford
Kingsbury Mach. Tool Corp., Keene, N. H.
Langelier Mfg. Co., Providence, R. I.
Manning, Maxwell & Moore, Inc., N. Y.
Moline (Ill.) Tool Co.
Rockford (Ill.) Drilling Mach. Co.
Pratt & Whitney Co., Hartford, Conn.
Sellers & Co., Wm., Philadelphia

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Carlton Machine Tool Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Harrington Co., Philadelphia
Morris Mach. Tool Co., Cincinnati
Reed-Prentice Corp., Worcester, Mass.
Sellers & Co., Wm., Philadelphia

Drilling Machines, Sensitive
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo (N. Y.) Forge Co.
Canedy-Otto Mfg. Co., Chicago Hts., Ill.
Hardinge Brothers, Chicago
Henry & Wright Mfg. Co., Hartford
High Speed Hammer Co., Rochester, N. Y.
Kingsbury Mach. Tool Corp., Keene, N. H.
Langelier Mfg. Co., Providence, R. I.
Leland-Gifford Co., Worcester, Mass.
Taylor & Fenn Co., Hartford, Conn.
U. S. Mch. Tool Co., Cincinnati

Drilling Machines, Vertical
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Canedy-Otto Mfg. Co., Chicago Hts., Ill.
Cincinnati (O.) Bickford Tool Co
Foote-Burt Co., Cleveland
Harrington Co., Philadelphia
Henry & Wright Mfg. Co., Hartford
Kingsbury Mach. Tool Corp., Keene, N. H.
Langelier Mfg. Co., Providence, R. I.
Leland-Gifford Co., Worcester, Mass.
Manning, Maxwell & Moore, Inc., N. Y.
Oesterlein Machine Co., Cincinnati
Rockford (Ill.) Drilling Mach. Co.
Superior Machine Tool Co., Kokomo, Ind.

Drills, Center
Cleveland (O.) Twist Drill Co.
Union Twist Drill Co., Athol, Mass.

Drills, Core
Eclipse Interchangeable Counterbore Co., Detroit

Drills, Portable, Elec. and Pneumatic
Black & Decker Mfg. Co., Towson, Md.
Buckeye Portable Tool Co., Dayton
Clark Electric Co., Jas., Jr., Louisville, Ky.
Standard Elect. Tool Co., Cincinnati

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

Drills, Twist and Flat
Ampco Twist Drill Co., Jackson, Mich.
Bay State Tap & Die Co., Mansfield, Mass.
Butterfield & Co., Derby Line, Vt.
Cleveland (O.) Twist Drill Co.
Greenfield (Mass.) Tap & Die Corp.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Drying Machines, Metal Parts
Colts Patent Fire Arms Mfg. Co., Hartford

Electrical Instruments
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., East Pittsburg

Electrical Supplies
Cutler-Hammer Mfg. Co., Milwaukee
General Electric Co., Schenectady
Simplex Wire & Cable Co., Boston
Westinghouse Elec. & Mfg. Co., East Pittsburg

Elevator Trucks
(See Trucks)

Elevators and Conveyors
Dodge Mfg. Co., Mishawaka, Ind.

Engraving Machinery
Gorton Mach. Co., Geo., Racine, Wis.

Extractors Oil
Barrett Leon J., Worcester, Mass.

Facing Machines
Preis & Co. H. P., Newark, N. J.

Fans, Electric
Buffalo (N.Y.) Forge Co.
General Electric Co., Schenectady

Files, Precision
American Swiss File & Tool Co., Elizabeth, N. J.

Files and Rasps
Simonds Saw & Steel Co., Fitchburg, Mass.

Filing Machines
Ames Co., B. C., Waltham, Mass.
Haskins Co., R. G., Chicago
Oliver Instrument Co., Adrian, Mich.
White Dental Mfg. Co., S. S., N. Y.

Filler, Iron (See Cements, Iron)
Filters, Oil
(See Oil Filtering)
Fittings, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Flexible Shaft Equipment
Keller Mech. Engr. Corp., Brooklyn

Forging Machinery
Acme Mchy. Co., Cleveland
National Mchy. Co., Tiffin, O.

Forgings, Die
Witherow Steel Corp., Pittsburg

Forgings, Drop
Gears & Forgings, Inc., Cleveland
Forgings, Flat Die
Gears and Forgings, Inc., Cleveland

Forgings, Weldless Rings
Gears and Forgings, Inc., Cleveland

Furnaces, Electric
Electric Furnace Co., Salem, O.

Furnaces, Forging
American Electric Furnace Co., Boston
American Gas Furnace Co., Elizabeth, N. J.
Strong, Carlisle & Hammond Co., Cleveland

Furnaces, Heat Treating, Tempering and Annealing
American Electric Furnace Co., Boston
American Gas Furnace Co., Elizabeth, N. J.
Electric Furnace Co., Salem, O.
General Electric Co., Schenectady
Hoskins Mfg. Co., Detroit
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Strong Carlisle & Hammond Co., Cleveland

Furnaces, Oil & Gas
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Strong, Carlisle & Hammond Co., Cleveland

Furniture, Machine Shop
Brown Eng. Co., Reading, Pa.
New Britain-Gridley Mach. Co., New Britain, Conn.

Gage Blocks
Johansson, C. C. (Div. of Ford Motor Co., Detroit)

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And there is another faithful *stand-by in your home and factory — and that is, CHROMEL. It serves as the heating-element in your toaster and in your electric furnaces. It forms the thermo-couple of your pyrometers. CHROMEL is also found in your heat-resistant castings.

CHROMEL has been doing these things for 23 years. Your experience with it surely has proven it to be trustworthy. Your heating-elements and castings are durable; your Chromel thermo-couples are accurate and long-lived; and per hour of service are cheaper than any other.

It will pay you to specify Chromel for your thermo-couples; for your electric furnace heating-elements; and for heat-resistant castings. For technical data on this old *stand-by, ask for Catalog F-AM.

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THERMO-COUPLES AND RESISTANCE WIRE

Pratt & Whitney Co., Hartford
Standard Gage Co., Inc., Poughkeepsie, N. Y.

Gages, Comparator
Federal Products Corp., Providence
Jones & Lamson Mch. Co., Springfield, Vt.

Gages, Dial
Ames, Co., B. C., Waltham, Mass.
Federal Products Corp., Providence
Lowe, Henry A., Cleveland
Standard Gage Co., Inc., Poughkeepsie
Starrett Co., L. S., Athol, Mass.

Gages, Plug and Ring
Brown & Sharpe Mfg. Co., Providence
Hanson-Whitney Machine Co., Hartford
Pratt & Whitney Co., Hartford, Conn.
Standard Gage Co., Inc., Poughkeepsie, N. Y.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Greenfield (Mass.) Tap & Die Corp.
Hanson-Whitney Machine Co., Hartford
Pratt & Whitney Co., Hartford, Conn.
Standard Gage Co., Inc., Poughkeepsie, N. Y.

Gages, Standard
Federal Products Corp., Providence
Johansson, C. C. (Div. of Ford Motor Co., Detroit)
Hanson-Whitney Machine Co., Hartford
Pratt & Whitney Co., Hartford, Conn.
Standard Gage Co., Inc., Poughkeepsie, N. Y.

Gages, Thread, Cylindrial
Johansson, C. C. (Div. of Ford Motor Co., Detroit)

Gas, Compressed, Welding & Cutting
Union Carbide & Carbon Corp., N. Y. C.

Gear Blanks, Composition
Bakelite Corp., N. Y. C.

Gear Cutting Machinery
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Bilgram Machine Works, Phila.
Brown & Sharpe Mfg. Co., Providence
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Harrington Co., Philadelphia
Newark (N. J.) Gear Cut Mch. Co.
Producto Machine Co., Bridgeport
Schuchardt & Schutte (Geo. Scherr Co., N. Y.
Waltham (Mass.) Machine Works
Whiton Mch. Co., D. E., New London, Conn.

Gear Tempering Machinery
Gleason Works, Rochester, N. Y.

Gear Testing Machinery
Adams Co., Dubuque, Iowa
Gleason Works, Rochester, N. Y.
Newark (N. J.) Gear Cut. Mch. Co.

Gear Tooth Rounders
Cross Gear & Engine Co., Detroit

Gears, Cast
Bond Co., Chas., Philadelphia
Brown Co., A. & F., Elizabethport, N. J.
Cleveland Worm & Gear Co., Cleveland
Dodge Mfg. Co., Mishawaka, Ind.
General Electric CSo., Schenectady
Hartford Special Machy. Co., Hartford
Philadelphia (Pa.) Gear Works
Sier-Bath Gear Co, N. Y.

Gears, Cut
Adams Co., Dubuque, Iowa
Atlantic Gear Works, Brooklyn
Bilgram Machine Works, Phila.
Boston Gear Works Sales Co., Quincy, Mass.
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., Elizabethport, N. J.
Cleveland Worm & Gear Co., Cleveland
Diefendorf Gear Corp., Syracuse
Earle Gear & Mch. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Gears & Forgings, Inc., Cleveland
Gleason Works, Rochester, N. Y.
Grant Gear Works, Boston
Hartford Special Machy. Co., Hartford
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Machine Co., W. A., Chicago
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Works
Sier-Bath Gear Co, N. Y.
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Gears & Forgings, Inc., Cleveland
Grant Gear Works, Boston
Hartford Special Machy. Co., Hartford
Horsburgh & Scott Co., Cleveland
Philadelphia (Pa.) Gear Wks.

Gears, Speed Reducing
Boston Gear Works Sales Co., Quincy, Mass.
Cleveland Worm & Gear Co., Cleveland
Dodge Mfg. Co., Mishawaka, Ind.
Earle Gear & Mach. Co., Phila.
Foote Bros. Gear & Mach. Co., Chicago
Gears & Forgings, Inc., Cleveland
Grant Gear Works, Inc., Boston
Hartford (Conn.) Special Machy. Co
Horsburgh & Scott Co., Cleveland
Morrison Mach. Co., Paterson, N. J.
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Works

Generators, Acetylene
Oxweld Acetylene Co., Long Island City
Union Carbide & Carbon Corp., N. Y. C.

Generators, Electric
General Electric Co., Schenectady
Reliance Elect. & Eng. Co., Cleveland

Generators, Electroplating
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburg

Glass Products, Industrial
Corning Glass Works, Corning, N. Y.

Grease Cups
(See Oil & Grease Cups)

Grinding Machines
Greenfield (Mass.) Tap & Die Corp.

Grinding Machines, Ball Bearing Race
(See Grinding Machines, Radial)

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Clark Electric Co., Jas., Jr., Louisville, Ky.
Haskins Co., R. G., Chicago
Marschke Mfg. Co., Towson, Md.
Norton Co., Worcester, Mass.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

Grinding Machines Centerless
Cincinnati (9.) Grinders, Inc.

Grinding Machines, Chaser
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland

Grinding Machines, Chucking
Blanchard Mach. Co., Cambridge
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Barber-Colman Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Greenfield (Mass.) Tap & Die Corp.
Heald Mach. Co., Worcester, Mass.
Norton Co., Worcester, Mass.
Oesterlein Machine Co., Cincinnati
Reed-Prentice Corp., Worcester, Mass.
Sellers & Co., Wm., Philadelphia
Taylor & Fenn Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

Grinding Machines, Cylinder
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Norton Co., Worcester, Mass.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Grinders Co.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.
Greenfield (Mass.) Tap & Die Corp.
Heald Machine Co., Worcester, Mass.
Oesterlein Machine Co., Cincinnati
Rivett Lathe & Grinder Corp., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Die
Abrasive Mch. T. Co., E. Providence
Bignall & Keeler Mach. Wks., Edwardsville, Ill.
Blanchard Mach. Co., Cambridge, Mass.
Geometric Tool Co., New Haven, Conn.
Heald Machine Co., Worcester, Mass.
Landis Machine Co., Waynesboro, Pa.
Murchey Mach. & Tool Co., Detroit
National Machinery Co., Tiffin, O.
Walker Co., O. S., Worcester, Mass.

Grinding Machines, Drill and Tap
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Wm., Philadelphia

Grinding Machines, Face or Ring Wheel
Abrasive Mch. T. Co., E. Providence
Blanchard Mach. Co., Cambridge, Mass.
Diamond Mach. Co., Providence
Graham Mfg. Co., Providence
Walker Co., O. S., Worcester

Grinding Machines, Flexible Shaft
Keller Mech. Engr. Co., Brooklyn

Grinding Machines, Floor
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Diamond Mach. Co., Providence
Marschke Mfg. Co., Towson, Md.
Norton Co., Worcester, Mass.
Walker Co., O. S., Worcester, Mass.

Grinding Machines, Gage
Abrasive Mch. T. Co., E. Providence

Grinding Machines, Hob
Schuchardt & Schutte (Geo. Scherr Co.), New York

Grinding Machines, Internal
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Cincinnati
Greenfield (Mass.) Tap & Die Corp.
Heald Mach. Co., Worcester, Mass.
Hjorth Lathe & Tool Co., Boston
Rivett Lathe & Grinder Corp., Boston
Van Norman Mach. Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

Grinding Machines, Piston Ring
Heald Machine Co., Worcester, Mass.

Grinding Machines, Portable
Black & Decker Mfg. Co., Towson, Md.
Buckeye Portable Tool Co., Dayton
Clark Electric Co., Jas., Jr., Louisville, Ky.
Haskins Co., R. G., Chicago
Standard Elect. Tool Co., Cincinnati
White Dental Mfg. Co., S. S., N. Y.

Grinding Machines, Pulley
Graham Mfg. Co., Providence

Grinding Machines, Radial
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Snagging
Marschke Mfg. Co., Towson, Md.

Grinding Machines, Surface
Abrasive Mch. T. Co., E. Providence
Blanchard Mach. Co., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence
Diamond Mach. Co., Providence
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Heald Mach. Co., Worcester, Mass.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Walker Co., O. S., Worcester, Mass.

Grinding Machines, Swing Frame
Marschke Mfg. Co., Towson, Md.

Grinding Machines, Tappet & Valves
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

Grinding Machines, Tool
Sellers & Co., Wm., Philadelphia

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati Grinders, Cincinnati
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Greenfield (Mass.) Tap & Die Corp.
Norton Co., Worcester, Mass.

Grinding Wheels
Norton Co., Worcester, Mass.
Vitrified Wheel Co., Westfield, Mass.

Guns
Spraco Inc., Boston

Hammers, Power
Bliss Co., E. W., Brooklyn, N. Y.
High Speed Hammer Co., Rochester, N. Y.
Ohio Electric Co. & Controller Co.,

Hammers, Soft Metal
Producto Machine Co., Bridgeport

Hammers, Steam
Sellers & Co., Wm., Philadelphia

Hangers, Shaft
American Pulley Co., Phila
Dodge Mfg. Corp., Mishawaka, Ind.
Gurney Ball Bearing Division, Jamestown, N. Y.
Marlin Rockwell Corp., Jamestown, N. Y.
Jones Fdry. & Machine Co., W. A. Chicago
Marlin-Rockwell Corp., Jamestown, N. Y.
S.K.F. Industries, N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.

Hardness Measuring Instruments, Steel
Rockwell Co., Stanley P., Hartford, Conn.
Shore Instrument & Mfg. Co., Jamaica, N. Y.
Wilson-Maeulen Co., N. Y. C.

Heating Equipment
York Heating & Ventilating Corp., Phila.

Heat Treating Instruments
Rockwell Co., Stanley P., Hartford, Conn.

Heaters, Rivet
American Gas Furnace Co., Elizabeth, N. J.
Buffalo (N. Y.) Forge Co.

Hobbing Machines
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence
Hanson-Whitney Machine Co., Hartford
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Philadelphia (Pa.) Gear Wks.
Union Mfg. Co., New Britain, Conn

Hoists, Chain
Union Twist Drill Co., Athol, Mass.
Wright Mfg. Co., Bridgeport, Conn.

Hoists, Hand
Harrington Co., Philadelphia

Hoists & Cranes, Elect. & Traveling
General Electric Co., Schenectady
Harrington Co., Philadelphia
Manning, Maxwell & Moore, Inc., N. Y.

Honing Machines
Barnes Drill Co., Rockford, Ill.

Hydraulic Machinery
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Indicators, Dial
Federal Products Corp., Providence
Lowe, Henry A., Cleveland
Standard Gauge Co., Inc., Poughkeepsie

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.
Veeder-Root, Hartford

Jacks, Planer
Armstrong Bros. Tool Co., Chicago

Jig Bushings
Acme Industrial Co., Chicago

Jigs
Siewek Tool Co., Detroit

Jigs & Fixtures
(See Contract Work)

Joints, Universal
Boston Gear Works Sales Co., Quincy, Mass.

Journal Bearings
Gray & Prior Mach. Co., Hartford

Kettles, Soda
Gray & Prior Mach. Co., Hartford

Keys, Machine
Whitney Mfg. Co., Hartford, Conn.

Keyseating Machines
Baker Bros., Toledo, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Lapointe Co., J. N., New London, Conn.
Mitts & Merrill, Saginaw, Mich.

Lamps, Electric
General Electric Co., Schenectady

Lapping Machines, Cylindrical and Flat
Norton Co., Worcester, Mass.

Lathe Attachments
Flather Co. (The) Nashua, N. H.
South Bend (Ind.) Lathe Works

Lathe Tools
Armstrong Bros. Tool Co., Chicago
O.K. Tool Co., Shelton, Conn.
Prosser & Son, Thos., N. Y.

Lathes, Automatic and Semi-Automatic
Bullard Co., Bridgeport, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
Potter & Johnston Mch. Co., Pawtucket
Pratt & Whitney Co., Hartford, Conn
Reed-Prentice Corp., Worcester, Mass.
Seneca Falls (N. Y.) Machine Co
Steinle Turret Mach. Co., Madison Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.

Lathes, Axle
Manning, Maxwell & Moore, Inc. N. Y.
Sellers & Co., Wm., Philadelphia

Lathes, Bed Gap
South Bend (Ind.) Lathe Works

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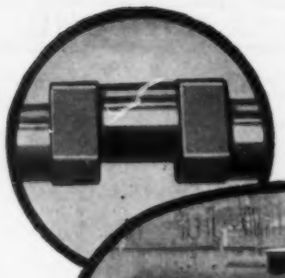
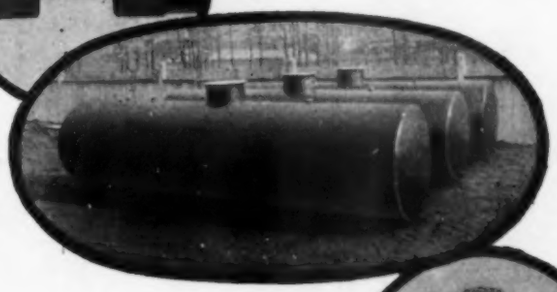
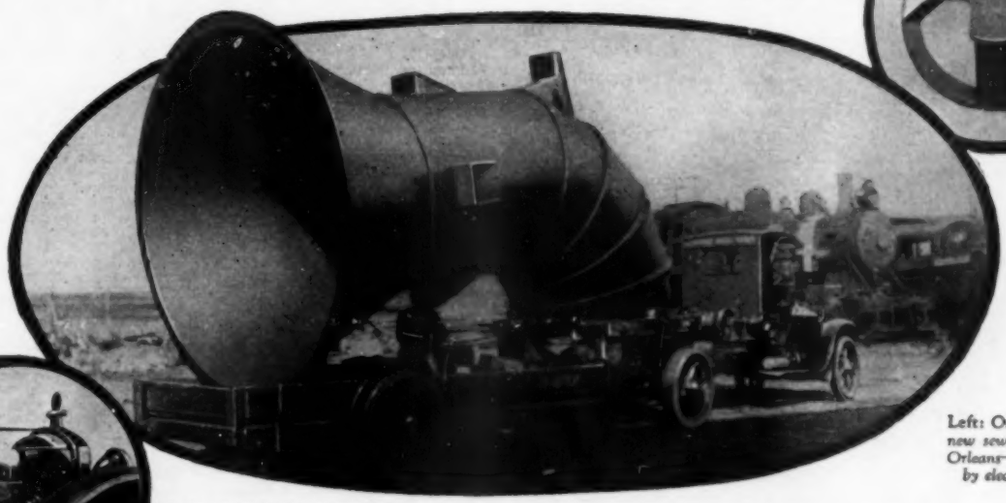


Left: *A 12-inch Crank Shaft which had cracked in half—rebuilt by the electric-arc.* Below: *Three 6,000-gallon Tanks, completely fabricated by electric-arc welding.*

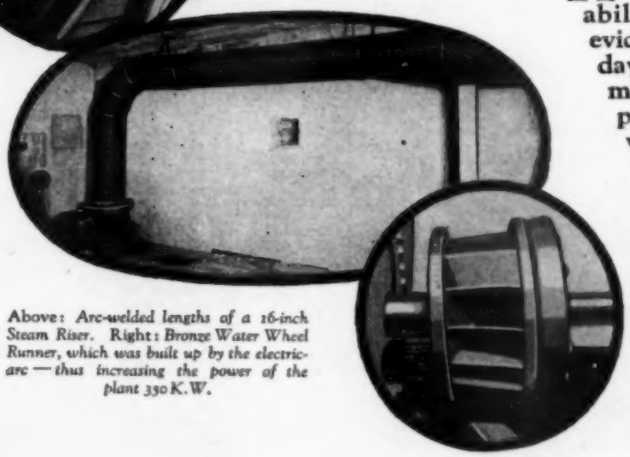


Right: *Generator Head, made of arc-welded structural steel units.*



Left: *One of the units in the new sewage system of New Orleans—entirely fabricated by electric-arc welding.*

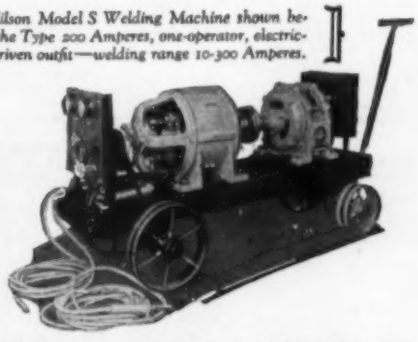
Left: *Cracked Cylinder Block, repaired by electric-arc welding.*



Above: *Arc-welded lengths of a 16-inch Steam Riser.* Right: *Bronze Water Wheel Runner, which was built up by the electric-arc — thus increasing the power of the plant 330 K.W.*

HERE is evidence of the remarkable versatility and dependability of electric-arc welding—evidence that is piling up day after day, and in every industry where metals are being joined. Here is proof that—whatever *your* industry, whatever *your* welding problems—you can profit by the manifold advantages of arc welding. ¶ Pioneers in electric-arc welding — Wilson places at your disposal its great accumulation of welding experience and knowledge. You are invited to consult its engineers—no obligation.

The Wilson Model S Welding Machine shown below is the Type 200 Amperes, one-operator, electric-motor-driven outfit—welding range 10-300 Amperes.



WILSON WELDER & METALS CO. INC., 10 WILSON BUILDING, HOBOKEN, N. J.

WILSON

WELDING MACHINES AND WELDING WIRE

Lathes, Bench
Ames Co., B. C., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Hardinge Brothers, Chicago
Hjorth Lathe & Tool Co., Boston
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Corp., Boston
Seneca Falls (N. Y.) Machine Co.
South Bend (Ind.) Lathe Works
Stark Too Co., Waltham, Mass.
Van Norman Mach. Tool Co., Springfield, Mass
Wade Tool Co., Waltham, Mass.

Lathes, Boring
Potter & Johnston Mch. Co., Pawtucket, R. I.
Sundstrand Mach. Tool Co., Rockford, Ill.

Lathes, Car Wheel
Sellers & Co., Wm., Philadelphia

Lathes, Chucking
(See Lathes, Horizontal & Vertical Turret)

Lathes, Engine
American Tool Wks. Co., Cincinnati
Boye & Emmes Machine Tool Co., Cincinnati
Cons. Mach. Tool Corp., Rochester
Flather Co. (The) Nashua, N. H.
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Greaves, Klusman Tool Co., Cincinnati
Hendey Machine Co., Torrington, Conn.
Lodge & Shipley Mach. Tool Co., Cincinnati
Monarch Mach. Tool Co., Sidney, O.
Morris Machine Tool Co., Cincinnati
Porter-McLeod Mach. Tool Co., Hatfield, Mass.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Seneca Falls (N. Y.) Machine Co.
South Bend (Ind.) Lathe Works
Sundstrand Mach. Tool Co., Rockford, Ill.
Springfield (O.) Mch. Tool Co.
Wickes Bros., Saginaw, Mich.

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati
Harrington Co., Philadelphia

Lathes, Horizontal and Vertical Turret
Acme Machine Tool Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence
Bullard Co., Bridgeport, Conn.
International Mach. Tool Co., Indianapolis
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.
Steinle Turret Mach. Co., Madison, Wis.
Warner & Swasey Co., Cleveland

Lathes, Locomotive Driving Wheel
Sellers & Co., Wm., Philadelphia

Lathes, Polishing
(See Polishing & Buffing)

Lathes, Spinning
Adriance Mach. Wks., Brooklyn

Lathes, Toolroom
American Tool Wks., Cincinnati
Hardinge Brothers, Chicago
Lodge & Shipley Mach. Tool Co., Cincinnati
Porter-McLeod Mach. Tool Co., Hatfield, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Corp., Boston
South Bend (Ind.) Lathe Works
Sundstrand Mach. Tool Co., Rockford, Ill.

Lathes, Wheel, Car & Locomotive
Manning, Maxwell & Moore, Inc., N. Y.

Letters and Figures
Hoggson & Pettis Mfg. Co., New Haven, Conn.

Level Precision Machines, Aligning
Pratt & Whitney Co., Hartford, Conn.
Universal Bor. Mach. Co., Hudson

Lining, Brake & Clutch
Raybestos Co., Bridgeport

Lubricants
Oakite Products, N. Y.

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Magnets, Lifting
Cutler-Hammer Mfg. Co., Milwaukee
Ohio Electric & Controller Co., Cleveland

Mandrels, Expanding
Nicholson & Co., W. H., Wilkes-Barre

Mandrels, Expanding, Air Operated
Logansport Machine Co., Logansport, Ind.

Mandrels, Solid
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

Marking Devices
(See Stamps, Steel)

Marking Machines
Noble & Westbrook Mfg. Co., Hartford
Preis & Co., H. P., Newark, N. J.

Measuring Machines
Hanson-Whitney Machine Co., Hartford
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Pratt & Whitney Co., Hartford, Conn.
Carl Zeiss, (Geo. Scherr Co.), N. Y.

Meters-Steam Flow
General Electric Co,, Schenectady

Micrometers, Bench
Pratt & Whitney Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Milling Attachments
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker, Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Machine Co., Cincinnati
Potter & Johnston Mch. Co., Pawtucket, R. I.
Producto Machine Co., Bridgeport
Reed-Prentice Corp., Worcester, Mass.
Shields Machine Tool Co., N. Y. C.
Sundstrand Mach. Tool Co., Rockford, Ill.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., Hartford, Conn.
Producto Machine Co., Bridgeport
Shields Machine Tool Co., N. Y. C.
Sundstrand Mach. Tool Co., Rockford, Ill.

Milling Machines, Bench
Ames Co., B. C., Waltham, Mass.
Hardinge Brothers, Chicago
Pratt & Whitney Co., Hartford, Conn.
Stark Tool Co., Waltham, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Continuous
Cons. Mach. Tool Corp., Rochester
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Producto Machine Co., Bridgeport
Sundstrand Mach. Tool Co., Rockford, Ill.

Milling Machines, Duplex
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Producto Machine Co., Bridgeport
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Floor Plate
Sellers & Co., Wm., Philadelphia

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Pratt & Whitney Co., Hartford, Conn.
Producto Machine Co., Bridgeport
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Horizontal and Planer Type
Cincinnati Planer Co., Cincinnati
Cons. Mach. Tool Corp., Rochester
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Oesterlein Mach. Co., Cincinnati
Sellers & Co., Wm., Philadelphia

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker, Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Machine Co., Cincinnati
Potter & Johnston Mch. Co., Pawtucket, R. I.
Producto Machine Co., Bridgeport
Shields Machine Tool Co., N. Y. C.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Portable
Ingersoll Milling Mach. Co., Rockford, Ill.

Milling Machines, Thread
Hanson-Whitney Machine Co. Hartford
Harrington Co., Philadelphia
Pratt & Whitney Co., Hartford, Conn.
Producto Machine Co., Bridgeport
Waltham (Mass.) Mach. Wks.

Milling Machines, Traveling Work Table
Sellers & Co., Wm., Philadelphia

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Hendey Machine Co., Torrington, Conn.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker, Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Machine Co., Cincinnati
Potter & Johnston Mch. Co., Pawtucket, R. I.
Shields Machine Tool Co., N. Y. C.
Sundstrand Mach. Tool Co., Rockford, Ill.
U. S. Mch. Tool Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cons. Mach. Tool Corp., Rochester
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker, Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Reed-Prentice Corp., Worcester, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Worm
Cleveland Auto Mach. Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.
Producto Machine Co., Bridgeport
Waltham (Mass.) Mach. Wks.

Milling Tools, Adjustable, Hollow
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Geometric Tool Co., New Haven, Conn.

Motors, Electric
Burke Elec. Co., Erie, Pa.
General Electric Co., Schenectady
Lincoln Electric Co., Cleveland
Ohio Electric & Controller Co., Cleveland
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elec. & Mfg. Co., East Pittsburg
Zabell Elec. Motor Corp.

Name Plates
Schwerdtle Stamp Co., Bridgeport

Nitrogen, Gas
Union Carbide & Carbon Corp., N. Y. C.

Numbering Machines
Noble & Westbrook Mfg. Co., Hartford

Nut, Setters
Jarvis Co., Chas. L., Gildersleeve, Conn.

Nut Tappers
(See Bolt & Nut Machinery)

Nut-Threading Machine, Automatic
Automatic Nut-Thread Corp., Philadelphia

Nuts, Castellated
National Acme Co., Cleveland

Oil and Grease Cups
Bay State Stamping Co., Worcester
Gits Bros. Mfg. Co., Chicago
Tucker, W. W. & C. F., Hartford, Conn.

Oil Filtering & Storage Systems
Motor Improvements, Newark

Oil Grooving Machines
Hanson-Whitney Mach. Co., Hartford

Oil Stones
Norton Co., Worcester, Mass.

Oils
(See Lubricants)

Oxygen Gas
Union Carbide & Carbon Corp., N. Y. C.

Paint
Spraco Inc., Boston

Painting Equipment
Spraco Inc., Boston

Parallels
Starrett Co., L. S., Athol, Mass.

Pattern Shop Machinery
(See Woodworking Machinery)

Pipe Bending Machines
Harrington Co., Philadelphia

Pipe Cutting and Threading Machines
Bignall & Keeler Mach. Wks., Edwardsville, Ill.
Harrington Co., Philadelphia
Landis Machine Co., Waynesboro, Pa.
Merrell Mfg. Co., Toledo
Murchey Machine & Tool Co., Detroit
Williams Tool Corp., Erie, Pa.

Pipe Fitters' Tools
Butterfield & Co., Derby Line, Vt.
Greenfield (Mass.) Tap & Die Corp.

Planing Machines
American Tool Wks. Co., Cincinnati
Cincinnati (O.) Planer Co.
Cleveland (O.) Planer Co.
Cons. Mach. Tool Corp., Rochester
Gray Co., G. A., Cincinnati
Sellers & Co., Wm., Philadelphia

Plating, Chromium
United Chromium, N. Y. C.

Plating Equip. & Supplies
Hanson-Van Winkle-Munning Co., Matawan, N. J.

Pneumatic Tools
Buckeye Portable Tool Co., Dayton

Polishing and Buffing Machines
Barnes Co., W. F. & John, Rockford, Ill.
Blanchard Mach. Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Greenfield (Mass.) Tap & Die Corp.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Heald Machine Co., Worcester, Mass.
New Britain-Gridley Mach. Co., New Britain, Conn.
Rowbottom Mach. Co., Waterbury, Conn.
Standard Elect. Tool Co., Cincinnati
Union Twist Drill Co., Athol, Mass.
Van Norman Mach. Tool Co., Springfield, Mass.

Polishing & Buffing Machs. Elect. Portable
Clark Electric Co., J. Jr., Louisville
Standard Elec. Tool Co., Cincinnati

Post Boxes
Standard Pressed Steel Co., Jenkintown, Pa.

Press Feeds
Littell Mach. Co., F. J., Chicago
V. & O. Press Co., Hudson, N. Y.

Pressed Steel Parts
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Truscon Steel Co. (Hydraulic Pressed Steel Division) Cleveland

Presses, Arbor
Barnes Co., W. F. & John, Rockford, Ill.
Logansport Machine Co., Logansport, Ind.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

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Bliss Co., E. W., Brooklyn, N. Y.
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Toledo (O.) Mach. & Tool Co.

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Bliss Co., E. W., Brooklyn, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo
Taylor & Fenn Co., Hartford, Conn.

Presses, Forcing
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Eng. Wks., Chas. F., Chicago
Lucas Mach. Tool Co., Cleveland
Watson-Stillman Co., N. Y.

Presses, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Presses, Power
Adriance Mach. Wks., Brooklyn
Barnes Co., W. F. & John, Rockford, Ill.
Bliss Co., E. W., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
General Mfg. Co.
Henry & Wright Mfg. Co., Hartford
Niagara Mach. & Tool Wks., Buffalo
Pels & Co., Henry, N. Y.
Rowbottom Mach. Co., Waterbury, Conn.
Toledo (O.) Mach. & Tool Co.
V&O Press Co., Hudson, N. Y.

Presses, Screw
Barnes Co., W. F. & John, Rockford, Ill.
Bliss Co., E. W., Brooklyn, N. Y.

Profiling Machines
Pratt & Whitney Co., Hartford, Conn.
Stark Tool Co., Waltham, Mass.
Wade Tool Co., Waltham, Mass.

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American Pulley Co., Philadelphia
Brown Co., A. & F., Elizabethport, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A., Chicago

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Ohio Valley Pulley Works, Maysville, Ky.

Pulleys, Steel Split
Dodge Mfg. Co., Mishawaka, Ind.

Pumps, Hydraulic & Power
Elmes Eng. Wks., Chas F., Chicago
Watson-Stillman Co., N. Y.

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Brown & Sharpe Mfg. Co., Providence

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National Acme Co., Cleveland, Ohio

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Starrett Co., L. S., Athol, Mass.

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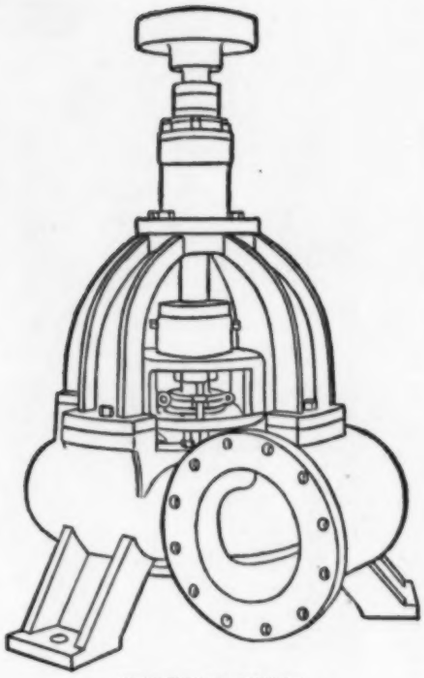

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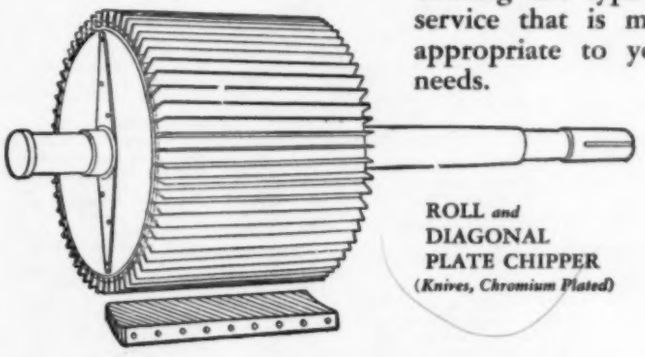

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Gammons-Holman Co., Manchester, Conn.
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Union Twist Drill Co., Athol, Mass.
Reaming Machines
Blanchard Mach. Co., Cambridge, Mass.
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Recorders, Temperature
Bristol Co., Waterbury, Conn.
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Cutler-Hammer Mfg. Co., Milwaukee
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., East Pittsburg
Rheostats Electroplating
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National Machinery Co., Tiffin, O.
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Grant Mfg. & Machine Co., Bridgeport, Conn.
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Rules, Steel
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Starrett Co., L. S., Athol, Mass.
Thompson & Son Co., Henry G., New Haven
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Simonds Saw & Steel Co., Fitchburg, Mass.
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Armstrong-Blum Mfg. Co., Chicago
Sawing Machines, Metal
Earle Gear & Machine Co., Phila.
Peerless Machine Co., Racine, Wis.
Racine (Wis.) Tool & Mach. Co.
Thompson & Sons Co., Henry G., New Haven
Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago.
Peerless Machine Co., Racine, Wis.
Racine (Wis.) Tool & Mach. Co.
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Simonds Saw & Steel Co., Fitchburg, Mass.
Thompson & Son Co., Henry G., New Haven
Saws, Circular Wood Cutting
Simonds Saw & Steel Co., Fitchburg, Mass.
Saws, Cross Cut and Hand
Simonds Saw & Steel Co., Fitchburg, Mass.
Saws, Hack
Armstrong, Blum Mfg. Co., Chicago
Saws, Inserted Tooth
Simonds Saw & Steel Co., Fitchburg, Mass.
Saws, Metal Cutting
American Saw & Mfg. Co., Springfield, Mass.
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Simonds Saw & Steel Co., Fitchburg, Mass.
Saws, Milling
Barber-Colman Co., Rockford, Ill.
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Simonds Saw & Steel Co., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.
Saws, Screw Slotting
Simonds Saw & Steel Co., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.
Scales
Starrett Co., L. S., Athol, Mass.
Scraping Attachments, Spot
Anderson Bros. Mfg. Co., Rockford, Ill.
Scraping Machines, Metal
Anderson Bros. Mfg. Co., Rockford, Ill.
Jarvis Co., Chas. L., Gildersleeve, Conn.
Screw Drivers, Automatic
Errington Mech. Laboratory, N. Y.
Screw Driving Attachments
Cleveland Twist Drill Co., Cleveland, Ohio
Screw-Machine Work
Eastern Mch. Screw Corp., New Haven
Morris Machine Tool Co., Cincinnati
National Acme Co., Cleveland
New Britain-Gridley Mach. Co., New Britain, Conn.
Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Auto Mach. Co.
Cone Auto. Mch. Co., Windsor, Vt.
National Acme Co., Cleveland
New Britain-Gridley Mach. Co., New Britain, Conn.
Screw Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Auto Mach. Co.
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland
Screw Plates
Bay State Tap & Die Co., Mansfield, Mass.
Brubaker & Bros. Co., W. L., Millersburg, Pa.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, O.
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford, Conn.
Screw Thread, Locking
Dardelet Threadlock Corp., N. Y. C.
Screws, Cap and Set
Allen Mfg. Co., Hartford
Bristol Co., Waterbury, Conn.
Danly Machine Specialties, Inc., Chicago
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland
Screws, Machine
Allen Mfg. Co., Hartford
Bristol Co., Waterbury, Conn.
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland
Screws, Safety Set
(See Screws, Cap & Set)
Seamless Steel Tubing
(See Tubing, Seamless Steel)
Second-Hand Machinery
(See Searchlight Section)
American Hoist & Derrick Co., St. Paul
Brownell Machy. Co., Providence
Delta Equip. Co., St. Paul
De Witt Tool Co., N. Y.
Eastern Machinery Co., Cincinnati
Essley Mchy. Co., Chicago
General Mchy. Corp., Boston
Hill, Clarke & Co., Chicago
Hyman & Sons, J., Phila.
Miles Machy. Co., Saginaw, Sidney, O.
Monarch Machine Tool Co., Morey & Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus
Riverside Mchry. Depot, Detroit
Shauer Machine Co., Cincinnati.
Simmons Mach. Tool Corp., Albany
Strafer Machy. Co., Jersey City
Taylor-Hall Welding Corp., Worcester
Separators, Centrifugal
National Acme Co., Cleveland
Separators, Oil & Waste
Barrett Leon J., Worcester, Mass.
Dodge Mfg. Corp., Mishawaka, Ind.
Shafting
Bliss & Laughlin, Harvey, Ill.
Strand & Co., N. A., Chicago
Shafts, Flexible
Haskins Co., R. G., Chicago
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White Dental Mfg. Co., S.S., N. Y.
Shafts, Splined
Adams Co., Dubuque, Iowa
Shapers
American Tool Wks. Co., Cincinnati
Cincinnati (O.) Shaper Co.
Hanson-Whitney Machine Co., Hartford
Hendey Machine Co., Torrington, Conn.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Corp. Worcester, Mass.
Smith & Mills Co., Cincinnati
Springfield (O.) Machine Tool Co.
Shear Blades
Simonds Saw & Steel Co., Fitchburg, Mass.
Shears, Hand
Tucker, W. W. & C. F., Hartford, Conn.
Shears, Power
Adriance Mach Wks., Brooklyn
Buffalo (N. Y.) Forge Co.
Consolidated Machine Tool Corp., Rochester
Ferracute Machine Co., Bridgeton, N. J.
Mitts & Merrill, Saginaw, Mich.
Niagara Mch. & Tool Wks., Buffalo
Pels & Co., Henry, N. Y.
Toledo (O.) Mach. & Tool Co
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Adriance Mach Wks., Brooklyn
Bliss Co., E. W., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mch. & Tool Wks., Buffalo
Toledo (O.) Mach. & Tool Co.
Slotting Machines
Cons. Mach. Tool Corp., Rochester
Sellers & Co., Wm., Philadelphia
Special Machinery
(See Contract Work)
Special Machinery & Tools
(See Contract Work)
Speed Reducers
Adams Co., Dubuque, Ia.
Boston Gear Works, Sales Co., Quincy, Mass.
Cleveland Worm & Gear Co., Cleveland
Foote Bros. Gear & Mach. Co., Chicago
Gears & Forgings, Inc., Cleveland
Grant Gear Works, Boston
Hartford Special Machinery Co., Hartford
Jones Fdry. & Machine Co., W. A., Chicago
Morrison Mach. Co., Paterson, N. J.
Philadelphia (Pa.) Gear Wks.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Spindles
Ex-Cell-O Tool & Mfg. Co., Detroit
Springs
Wickwire Spencer Steel Corp., N. Y. C.
Spring Winders
Hjorth Lathe & Tool Co., Boston
Sprockets and Chains
Bilgram Mach. Wks., Philadelphia
Boston Gear Works, Sales Co., Quincy, Mass.
Cullman Wheel Co., Chicago
Grant Gear Wks., Boston
Jones Fdry. & Machine Co., W. A., Chicago
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Works
Sier-Bath Gear Co, N. Y.
Whitney Mfg. Co., Hartford, Conn.
Squares
Starrett Co., L. S., Athol, Mass.
Stampings, Metal
American Pulley Co., Philadelphia
Bay State Stamping Co., Worcester
Detroit (Mich.) Stamping Co.
Parish Pressed Steel Co., Reading, Pa.
Stamps, Steel
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Noble & Westbrook Mfg. Co., Hartford
Schwerdtle Stamp Co., Bridgeport, Conn.
Stands, Portable
(See Furniture, Machine Shop)
Steel
Bliss & Laughlin, Harvey, Ill.
Carnegie Steel Co., Pittsburgh
Steel, Acid Resisting
Babcock & Wilcox Tube Co., N.Y.C.
Central Alloy Steel Corp., Massillon, O.
Ludlum Steel Co., Watervliet, N. Y.
Steel, Bar
Timken Roller Bearing Co., Canton, O.
Steel, Cold Drawn
Vanadium Alloys Steel Co., Latrobe, Pa.
Steel, Crucible
Columbia Tool Steel Co., Chicago Heights, Ill.
Simonds Saw & Steel Co., Fitchburg, Mass.
Steel, Electric Furnace
Timken Roller Bearing Co., Canton, O.
Steel, Sheet
American Sheet & Tin Plate Co., Pittsburgh
Hawkridge Bros. Co., Boston
Simonds Saw & Steel Co., Fitchburg, Mass.
Steel, Stainless
Babcock & Wilcox Tube Co., N.Y.C.
Central Alloy Steel Corp., Massillon, O.
Ludlum Steel Co., Watervliet, N. Y.
Steels, Alloy Carbon, and High Speed
Central Alloy Steel Corp., Massillon, O.
Columbia Tool Steel Co., Chicago Heights, Ill.
Hawkridge Bros. Co., Boston
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Ryerson & Son, Jos. T., Chicago
Timken Roller Bearing Co., Canton, O.
Truscon Steel Co. (Hydraulic Pressed Steel Division) Cleveland
Simonds Saw & Steel Co., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Ziv Steel & Wire Co., Chicago
Steels, Die
Ziv Steel & Wire Co., Chicago
Stools, Shop
(See Furniture, Machine Shop)
Storage Equipment, Paint, Oil, etc.
Bowser & Co., S. F., Fort Wayne, Ind.
Straightening Machinery
Springfield (O.) Mch. Tool Co.
Stud Setters
Procunier Safety Chuck Co., Chicago
Stud Setters, Self Opening
Errington Mech. Laboratory, N. Y.
Geometric Tool Co., New Haven, Conn.
Subpresses and Dies
Danly Mach. Spec., Inc., Chicago
U. S. Tool Co., Ampere, N. J.
Waltham (Mass.) Mach. Wks.
Swaging Machines
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Torrington Co., Torrington, Conn.
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Taper Pins
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Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Tapping Machines and Attachments
Acme Machinery Co., Cleveland
American Tool Wks. Co., Cincinnati
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Baker Bros., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Cincinnati (O.) Bickford Tool Co.
Errington Mech. Laboratory, N. Y.
Geometric Tool Co., New Haven, Conn.
Harrington Co., Philadelphia
Jarvis Co., Charles L., Gildersleeve Conn.
Langelier Mfg. Co., Providence, R. I.
Mitchell Engineering Co., Springfield, O.
Moline (Ill.) Tool Co.
Murchey Mach. & Tool Co., Detroit
National Machinery Co., Tiffin, O.
Procunier Safety Chuck Co., Chicago
Superior Machine Tool Co., Kokamo, Ind.
Taps and Dies
Bay State Tap & Die Co., Mansfield, Mass.
Brubaker & Bros. Co., W. L., Millersburg, Pa.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield.
Greenfield (Mass.) Tap & Die Corp.
Hanson-Whitney Machine Co., Hartford

A view of the Chemical Laboratory where raw materials are tested.

A Physical Testing Laboratory showing Laboratory Check on Brinell Hardness of Permite Castings.

Tensile Testing Machinery and Physical Laboratory. Determinations of Tensile Properties of Metals and Alloys made here.

SCIENTIFIC TESTING

in our laboratories reveals superiority of Aluminum Industries' permanent-mold aluminum-alloy castings

The Aluminum Industries, Inc., is exceptionally well fitted to supply manufacturers with superior aluminum-alloy castings. Pioneers in the field of permanent-mold casting, the Aluminum Industries production is completed entirely within its own shops.

The Aluminum Industries, Inc. for the past ten years has produced castings by the two accepted methods—sand and permanent mold. In the permanent-mold method, aluminum-alloy is poured without pressure into cast-iron, steel-cored molds. The even flow of the metal does not permit the formation of gases as in sand castings, and eliminates porosity and blow holes.

Our research has found that the molten metal contracting with the mold and core, which are of lower temperature, creates a chill cast surface of close grain structure and unusual wear-resisting qualities. The castings are uniform because there can be no core shift, as in sand castings.

Machining operations, with this method, are considerably reduced and in some cases eliminated. The resulting saving of costs are handed on to the trade in the form of lower prices.

We safeguard our clients' interests by unusual care in testing and scientific inspection of raw material, molds, and finished castings. Each consignment of raw materials is tested by our chemists and engineers. Every mold is inspected by our engineers before being placed in use. Castings are submitted to the Brinell-Hardness test and subjected to micro-metallography. Every casting is inspected by trained workers after each machining process. This rigid care in production results in uniform high quality.

The Permite Piston, standard equipment with manufacturers producing more than a million cars a year, is an outstanding success and the result of the extreme care we maintain in production. Allow our Engineering Department to advise you regarding the design and production of aluminum-alloy castings for your requirements. Write to us today for detailed information.

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Geometric Tool Co., New Haven, Conn.
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Taps, Ground
Hanson-Whitney Mach. Co., Hartford
Jones & Lamson Mach. Co., Springfield, Vt.
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Wrenches, Ratchet
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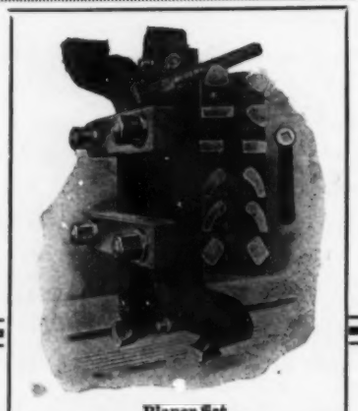

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Operating Controls and Brakes

OHIO Torque Motors are widely used in place of Solenoids for Controls and Brakes, because of their *economy*, *quiet operation* and *unfailing performance.*

Ohio Torque Motors are wound special (Patent Applied For). They are recommended for operating conditions where a slow speed or locked condition with a high torque is required without excessive heating. These characteristics are especially desired for operation of *Elevator Controls, Door Opening Appliances, Brakes* and similar devices.

These motors are used to close a switch or series of switches. They are often opened by counter weights, although the motor may be readily reversed electrically.

Unfailing rotation is so essential in this type of service that ball bearings are used. Rotation is thus assured, even though oiling may be neglected.

Ohio Torque Motors are very quiet, positive in action and uniform.

Made for Various Types of Service

100% Locked Service: For services where the motor may be locked across the line for several hours at a time; in fact, this type may remain locked across the line for 24 hours without injury to the motor.

50% Locked Service: For services where the motor is locked across the line approximately 50% of the time; that is, say, 30 seconds on and 30 seconds off. This type of motor may remain locked across the line for one hour without injury to the motor.

25% Locked Service: For services where the motor is locked across the line 25% of the time; that is, say, 15 seconds on and 45 seconds off. This type may remain locked across the line for 20 minutes without injury to the motor.

10% Locked Service: For services where the motor is locked across the line about 10% of the time; that is to say, 6 seconds on and 54 seconds off. This type may be left locked across the line for 10 minutes without injury to the motor.

Ohio Torque Motors are available in sizes of 3 to 64 ounce feet Torque. Complete details and dimensions are available on request.

The Ohio Electric & Controller Co.
5903 Maurice Ave., Cleveland, Ohio

Also manufacturers of a complete line of
Standard A.C. and D.C. Motors

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